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MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XXXVIII

1950

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MISSOURI BOTANICAL GARDEN BULLETIN

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Volume XXXVIII January, 1950 Number 1

Cover: Sleet storm at the Garden. Photograph by Claude Johnston.

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 40,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until 7:00 p. m.; Sundays, 10:00 a. m. until 7:00 p. m. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah bus line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

Cactus and Succulent Display in window of the Boatmen's National Bank

Missouri Botanical Garden Bulletin

Vol. XXXVIII JANUARY, 1950 No. 1

SIXTY-FIRST ANNUAL REPORT OF THE DIRECTOR

As is customary in the January issue of the BULLETIN, the Director of the Missouri Botanical Garden has the pleasure of presenting to the Board of Trustees and Friends of the Garden a report of the chief events and activities at the Garden during 1949:

BOATMEN'S BANK FEATURES THE GARDEN

During August the windows of the Boatmen's National Bank Building attracted wide attention when the Missouri Botanical Garden was featured. Each of the eight windows on the ground floor of the Bank aimed to show a special Garden activity which was explained by large printed posters. The window devoted to plant research, for instance, contained coal-balls and rocks in which plants had been embedded for millions of years, this illustrating the work being done by the paleobotanists (fossil botanists) in deciphering the story of plants throughout the ages. The same window displayed ears and stalks of exotic corn; the classification and origin of corn is another research subject at the Garden. A collection of mounted herbarium specimens exemplified taxonomic research, and a printed poster told the story of the herbarium and its uses.

Another window represented a desert scene, with an oil painting of a western desert as a background and the foreground planted with cacti and desert plants of which the Garden has a notable collection. The orchid window always attracted a crowd, for here was demonstrated the growing of orchid plants from seedlings in flasks to mature plants bearing gorgeous flowers. Fresh-blooming plants were delivered to the Boatmen's Bank weekly.

In the "conservation" window there was a landscape model showing water running over miniature hills into valleys, to illustrate the destructive effect of falling rain when not controlled by proper conservation practice—a matter of investigation at the Garden Arboretum.

Horticultural research was depicted by two large charts of rose bushes, with graphic directions for pruning. The window devoted to Henry Shaw

and the Garden contained a portrait of Shaw, the Garden's founder, painted about 1870. The many medals and cups awarded the Garden at expositions and flower shows were also shown, as well as a poster giving a short history of the Garden.

The window in the lobby of the Bank building was filled with old herbals and rare books from the Garden library, which are representative of those consulted by botanists from all over the world. A collection of books by members of the Garden staff and examples of the Garden publications were exhibited in the window on "Research."

The City Garden

MAINTENANCE

This year has been uneventful from the standpoint of destructive storms such as the tornado on September 1, 1946, which brought devastation in the Garden, and the wind storm of December 5, 1948, which wrecked the north end of the pergola and also did considerable damage to trees. Continued pruning of trees and shrubs the last two years has finally brought the Main Garden into shape. In 1949 work was concentrated in the North American Tract, where 161 dangerous trees left by the 1946 storm were removed. Two hundred trees, including oaks, ginkgos, horse-chestnuts, Chinese pagoda, and gums, have been planted in the Main Garden and nursery to replace the loss. A total of 291 loads of damaged trees and brush were removed.

The canker worm, which builds the familiar webs on trees, was evident in the Garden but was controlled by using 700 gallons of insecticide in the power sprayer. Collecting and removing the leaves in the autumn is a very important annual job, since after stacking and shredding they are used the following year on the lawns and in potting soil. In addition to the 160 loads of leaves from the Garden areas, 100 loads were obtained from the City street department. These will yield between 30 and 40 loads of excellent compost. Two acres of ground in the North American Tract were plowed and planted with cowpeas, and next year this soil, when mixed with the compost, will be used for greenhouse work. The plaza between the Main Gate and the Palm House was reseeded to blue grass in 1949.

The main construction work during the year consisted of rebuilding, under contract, the north end of the Italian Garden pergola and repairing the center and southern portions. The entire area was painted by use of the Garden's power sprayer. In repair of the greenhouses it was necessary to replace both the angle iron purlins and the angle iron sides which brace the support for the ventilators. The total amount of angle iron that was cut in varied lengths was 530 feet, 16 feet of 3″ x 3″ and 80 feet of 2″ x 2″ having been purchased new for the Floral Display House, and 434 feet salvaged from the slate benches in the growing houses which had been

Repairing the damage to the pergola in the Italian Garden caused by the windstorm of December 1948.

replaced by more permanent concrete benches. The interior of the Palm House from the floor up to and including the tongue and grooved area was sprayed with aluminum paint, and the south gable end of the roof was painted by hand. All the copper downspouts were replaced.

The ladies' rest room and new lavatory at the Main Office and the Power Plant window-sash and the interior of the Floral Display House balcony from the floor to the gable were repainted by hand. The Citrus House vestibule, the 47 permanent concrete garden benches, and the galvanized areas and pipe guard railings on all houses were repainted by the use of the spraying machine. Four growing-houses have been entirely repainted and reglazed. New ventilators and new sash bars were replaced where necessary. The total amount of glass area repainted amounted to 7,176 square feet.

Work was continued at various times throughout the year on rebuilding the steamlines, particularly in the large conservatories. New 1¼-inch pipe replaced amounted to 2,425 feet, and 1,816 feet of old pipe, which was installed in the large conservatories in 1912-13, were pressure-tested and the ends cut and rethreaded. Couplings, elbows, valves, etc. were all replaced. Small roof leaks being evident on the rest rooms and office at the Main Gate, the entire roof of the structure was recaulked and retreated with asphalt. One hundred new chromium chairs have been placed in the lecture room of the Museum to replace the old folding desk chairs which had been in use for thirty years.

Contract work, in addition to rebuilding the Italian Garden pergola (finished July 14), included new copper downspouts in the Palm House and a new asphalt shingle roof on the Assistant Engineer's residence on Shaw and Alfred.

Mr. Ladislaus Cutak, in charge of the Main Conservatories, and Mr. B. J. Mennemeyer, who has charge of the Main Gate, stamped 1,379 labels and hand-printed 1,106 during the year.

The maintenance of the City Garden is under the direction of Mr. G. H. Pring, with certain special features, including the two heating plants, under the control of Mr. Gerald Ulrici, Business Manager, and Mr. A. H. Vogel, Consulting Engineer.

MAIN CONSERVATORIES AND EXOTIC RANGES

Routine work necessary to carry on the permanent displays proceeded as usual, and various improvements were made in all of the houses.

In the Cactus House a truckload of sand-humus mixture was added to increase fertility and porosity of the soil (thus minimizing the danger of overwatering). It was necessary to prune heavily the two fine specimens of Stinging Nettle Tree *(Cnidoscolus oligandrus)* because their limbs had reached the glass. These trees, raised from Brazilian seed in 1945, have now attained a 20-ft. stature. The Stinging Nettle Trees probably are not grown under glass anywhere except at the Garden. Our trees bear a profusion of burr-like cushions of "poison"-secreting spines on the light tan trunks, and any one merely brushing against them will experience a sensation akin to being stung by a swarm of bees. The spines also appear on the branches and on both surfaces of the large, five-lobed leaves.

Epiphyllums raised from cuttings collected in Mexican jungles by Mr. Tom MacDougall a few years ago have grown so well that trellises had to be provided for them. Trellises were also made for most of the rampant-growing cacti, for if given liberty many twining, climbing and creeping cacti become a nuisance in a collection. The large cuttings of various Cerei received from the Pirtle Cactus Garden of Edinburg, Texas, in 1948, have been rooted sufficiently to set out in permanent beds. Most of the night-blooming cacti again bloomed luxuriantly, proving that well-established plants will flower heavily from year to year when not disturbed. An exception is the stubborn Torch Cactus, *Cereus Jamacaru*, which has failed to produce a single flower in the last 22 years despite the fact that our plants remain healthy and undisturbed.

During the annual Autumn Cactus Show of the Henry Shaw Cactus Society a group of rare undescribed cacti was placed on exhibition by La Quinta—Mexico's largest cactus establishment. After the show the plants were donated to the Garden.

After attending the convention of the Cactus and Succulent Society of America in Phoenix during July, Ladislaus Cutak made a plant-collecting trip in Arizona. Several fine cacti which the Garden collection lacked, two 4-ft. Saguaros, a 5-ft. Bisnaga, and an unusually large Sweet Potato Cactus whose tuber weighed 85 lbs., were brought back. The Sweet Potato Cactus was in flower when collected, but the immature ovaries ripened into bright scarlet fruits in the greenhouse in September and continued to be attractive during the next four months.

The *Bromelia Balansae* hedge had several plants blossoming at one time during 1949. This species, commonly called "Heart of Flame" because of the brilliantly colored inflorescence which arises from the center of the crown of prickly leaves, is probably the showiest member of its group. In the latter part of November *Agave Sartori* sprouted its inflorescence, being the first century plant to come into bloom for a number of years.

In the South African House the tall Fish Poison Plant *(Euphorbia Tirucalli)* and a large clump of *Sansevieria cylindrica* were removed. Fifty-eight feet of border plants were obtained from a massive bed of *Sansevieria subspicata*. Several large cuttings of spurges were rooted and planted in beds where height was needed. As usual aloes bloomed profusely and for the second straight year a 6-foot *Aloe supralaevis* bore a bright orange flower spike. Another tree aloe *(Aloe africana)* produced innumerable flowers which in the immature stage resemble tiny bananas.

In the Economic House a truck-load of manure and leaf mold worked into the beds resulted in improvement of the plants. The three tallest trees, *Hura crepitans*, *Parkia Roxburghii* and *Elaeodendron quadrangulatum*, had to be pruned heavily. The jasmine vine, *Jasminum simplicifolium*, for the first time was covered with a blanket of white flowers from near ground level to the ceiling. It was the heaviest bloomer in the House. The flowering season extended for three months in late autumn and early winter, and each morning a shovelful of spent flowers was picked from the walk beneath the plant. Fifteen horticultural kinds of Hibiscus were received from the Walton Plant Farm of Willis, Texas, and grown as pot plants. It is planned to set these out in permanent beds. Many economic plants propagated from seed and cuttings were planted out at intervals in the beds where room was available.

In the Palm House 75 horticultural forms of Begonia were planted, with the hope that they will add color to the understory. African Violets have shown marked improvement and additional plants have been set out. Notable palms that have bloomed profusely include the Honduran *Attalea Cohune*, the North African *Phoenix dactylifera*, the North American *Sabal Palmetto*, the Chinese *Livistona chinensis*, and the Philippine *Arenga Ambong*. The

Cohune Palm is one of the most majestic in our collection. Its fronds are of enormous length and the large woody spathe surrounds a spadix bearing hundreds of flowers that shed copious pollen.

The trees in the Citrus House that had reached the glass roof received a very heavy pruning. The *Camoensia maxima* vine has formed an extensive canopy in the back of both the Aroid and Citrus houses and bore the greatest profusion of blooms since becoming established there. The perfume from the large white blossoms was wafted even into the Floral Display House during late autumn. Ixoras, Clerodendrons and Acalyphas have flowered remarkably well in the Aroid House. Several bushes of *Clerodendron fallax* were literally covered with bunches of scarlet bloom, and *Acalypha hispida* produced great masses of long pendent racemes.

The year was very good for water-lilies. Plants set out in the second week of May grew so vigorously that four men were engaged each afternoon throughout the summer removing the dead leaves and flowers, weeding the pools, etc. The lilies continued to bloom profusely until the first week in November. The nine plants of *Victoria Cruziana*, the famous Platter-Lily of the Amazon, in the center pool, were a great attraction to visitors. The huge round leaves average about 54 inches in width, and are able to support a great weight. A demonstration of the buoyancy of the leaves provided the *St. Louis Post-Dispatch* (Sept. 25, Sunday issue) with an interesting color feature, showing two children with a combined weight of 100 pounds standing on the leaves. About 1,500 seeds of the Platter-Lily were collected, the best harvest in seven years.

Tours of the Garden, requested by schools, conventions and garden clubs, were conducted by Mr. Ladislaus Cutak, in addition to his supervision of the Main Conservatories and Exotic Ranges.

OUTDOOR GARDENS

From January 18 to 20 shrubs and trees were sheathed in ice. The days following the ice storm were clear and cold, and as the sun shone through the branches all plants appeared to be studded with innumerable jewels. It was the most picturesque winter scene in many a year. Fortunately not many branches were broken and only the columnar junipers had to be straightened.

In a year when the eastern states are experiencing a drought, we have had more than the average amount of rain. In July, and again in October, heavy rains have brought the total precipitation to 43.39 inches, which is 7.45 inches above normal rainfall to December 15. Plant life always responds with good growth when there is ample moisture in the soil, and naturally the gardens grew luxuriantly this year. November was somewhat drier but only the evergreens and the new lawn in the main plaza had to be watered. This late dry period was relieved by good rains on December 11.

Early in the year, eight beds in the Rose Garden were remade by removing eighteen inches of soil and replacing it with fresh soil and manure. To plant these beds and to replace a few varieties in other beds 230 roses were purchased. Six additional truck-loads of soil were needed to top-dress most of the beds where the soil level had sunk below the sod. In May, the entire garden was mulched with twenty-one truck-loads of oak-tow. The roses were excellent in May and June, and there was another fine display of flowers in August and September.

The iris and peony garden was very good in May, and the mid-season and late peonies had an exceptional year because of the cool weather prevailing at that time. This garden will gradually be moved to a new location in the Economic Garden to make way for a nursery to be operated in connection with and adjacent to the experimental greenhouses. Towards that end, eight beds of iris were lifted in the autumn and stored in coldframes for spring planting. This iris garden, the last of the test gardens established in various parts of the country in cooperation with the American Iris Society, has been in this location for twenty-two years. Eleven varieties of iris were purchased, and 119 rhizomes, representing 50 varieties, were donated by Dr. L. F. Randolph, of Ithaca, N. Y., Mr. Clifford W. Benson, of St. Louis, and Robert Schreiner, of Salem, Oregon.

The Main Garden contained a display of tulips in May, and bedding plants during the summer months. The point plants of the variegated tapioca attracted a great deal of attention.

The Italian Garden contained a brilliant mass of bedding plants which grew well because of the abundant rains. The privet hedge needed frequent shearing, and to speed that operation, a second electrical hedge-clipper was purchased. After the pergola was rebuilt, the central semi-circular area was entirely replanted with columnar and prostrate junipers. Four large Pfitzer Junipers were also moved to the Main Gate.

Narcissi that had been growing in nursery rows for several years were lifted and naturalized in an area between the Palm House and the Rose Garden. Tulips, hyacinths, and various other bulbs were planted in the Linnean, Spring and Main gardens for the 1950 display.

As in previous years, the outdoor gardens have been under the supervision of Mr. Paul A. Kohl.

FLORAL DISPLAYS

At the beginning of the year, Garza Supreme chrysanthemums and buddleias were added to the poinsettia show. In mid-January, the Christmas display was removed to make way for the staging of primroses and cyclamens. The annual orchid show was on view from February 6 to 27, at which time

Missouri Botanical Garden display at the Greater St. Louis Flower and Garden Show, March 13–20

Annual Chrysanthemum Show in the Floral Display House, 1949

aybrid pitcher plants (Nepenthes) were also shown. Then followed displays of cinerarias, azaleas, genistas and tulips. At the Greater St. Louis Flower and Garden Show in the Kiel Auditorium, March 13–20, the Garden staged a 750-square-foot bulb garden. In the Easter exhibit, which opened on April 10, 300 Croft and Creole lilies were used, supplemented with many of the spring-blooming annuals such as schizanthus, marguerites, annual chrysanthemums and nasturtiums. On May 14 and 15, the flower house was given over to the St. Louis Horticultural Society for its annual Spring Flower and Iris Show.

Flowering and foliage plants were sent to Christ Church Cathedral as decoration for the annual flower sermon preached on May 22. In the Floral Display House, hydrangeas, delphiniums and salpiglossis were on display until early June; and then followed the summer show of agapanthus, begonias, fuchsias and caladiums. On October 1 and 2 the Greater St. Louis Dahlia Society held its show at the Garden. The Veiled Prophet Queen's bouquet was on view October 6. The Henry Shaw Cactus Society held its show in the Floral Display House October 8 and 9. The chrysanthemum show opened November 6, and the Christmas display December 11.

Mr. Paul A. Kohl is in charge of the growing of the material and arrangement of the floral displays.

The Arboretum

Some of the beauty of the Arboretum floral displays is marred during dry spells by clouds of dust which follow the heavy traffic of the automobiles over the grounds. This also makes driving hazardous, especially during Easter sunrise services, when 300 or more cars may arrive within the space of thirty minutes. The danger is only somewhat lessened when smaller groups arrive in a body to hold an outdoor meeting. During the past several years attempts have been made to dust-proof the gravel roads through the use of both asphaltic emulsions and tons of calcium chloride; neither method gave dependable results. During the past summer a standard penetration asphaltic pavement was laid at the main gate. About 5,736 gallons of emulsified asphalt, 335 tons of crushed stone, and 27 tons of torpedo gravel were required. While this closely follows standard specifications for such work, we cannot anticipate the failures which may follow freezing and thawing this winter. Subgrade drainage problems will certainly arise in some areas and appear as "boils" in spring. However, it is believed that this hard road will be no more costly than the constant blading and shaping required now and that the expense of replacing 50 or more tons of gravel per mile (blown away as dust) will be eliminated. A hard-surfaced road would have been impractical a few years ago, since much heavy equipment was on steel wheels.

To-day even farm machinery is rubber-mounted and can be moved anywhere over any surface. If successful, hard roads will be extended annually, using our own men and equipment as was done in this test.

A sleet storm struck on January 18 and continued more or less until January 29. The damage, which was most severe in the Pinetum, was finally cleaned up during the first week in February.

During the year, after the lake spillway had been graded and planted, 926 trees and shrubs (many large enough to be balled) were moved from the nurseries to permanent locations. The usual irrigating, mulching, and some experimental fertilizing were done. A Danheuser Tree Digger, a tractor-driven machine with a 24 inch auger, which was purchased during the year, has greatly simplified nursery work and has contributed greatly to the survival of the plants after planting. When holes are dug by hand it is impossible to chop up the clods of raw hard clay; as a result they are thrown back around the roots, leaving air pockets which cannot be filled even when water is used. The tree digger, with powered auger, leaves a rim of finely pulverized soil which is ideal for backfilling after the plant has been set. Some elms were removed and other work was done in the rhododendron plantations and in several other areas. While this work is time-consuming it becomes extremely necessary in some locations, especially those which have an understory of the correct species for that location.

Two fire calls from Hidden Valley required the moving of equipment and men to that locality. Neither fire caused much damage, but they would have become serious without the proper equipment and adequate man power. To facilitate entrance of the fire crews the grader was sent to the Valley to construct and re-blade 9/10 miles of road. This, however, is wholly inadequate for the rapid attack necessary when fighting such fires, and it is hoped that additional truck trails can be added during the coming year.

The restoration of quail cover, a project in which technicians of the Conservation Commission of Missouri will cooperate, was well under way by late summer. In order to learn more about the adaptability and value of plants to wild life the seeds of many species of potential quail foods were collected and planted in beds. At the same time the ever-increasing deer herd is attracting attention from the standpoint of game management. Probably the most complete and well-balanced diet in Missouri seems to be available at the Arboretum. Here, where there are no restrictions (except those we hope to impose to protect special plants), the food habits of deer are not exactly like those in areas where there are fewer species of plants.

The excavating of Pot-Hole Lake, which was begun in June and continued whenever time was available throughout the summer, is nearing completion. So far it has required digging and hauling of a half million cubic

feet of soil. When completed it will demonstrate the feasibility of using such small ponds as part of a watershed flood-control program. The lake was so named because it is the closest approach to the water holes of the great prairies and was dug in one of the largest grassed areas in the Arboretum. In the vicinity of the lake a special effort will be made to re-establish the prairie plants which seemingly occupied that region a century ago.

The difficulty of making a good seed bed and the wet weather which did not permit the cultivating of corn at the proper time reduced yield. The wet weather of autumn so delayed the combining of soy beans that the anticipated crop was not produced. However, ample quantities of hay and silage were put up for cattle feed, and the Aberdeen-Angus herd remains an important part of the farming operation.

Each dump truck was driven about 6,000 miles during the year and operated about 3,000 hours. More road grading and maintenance were done than in any previous year. Several heavy rains washed the gravel into the side ditches, making it necessary to re-blade completely the whole road system. Less mowing was done than has been customary, partly because cattle have been grazing over a wider area. Another advantage of cattle over a mower is that they leave the grass in a better condition.

A number of large signs, the lettering routed in the treated but unpainted boards, were made during the winter and erected in places where some operation was taking place to which special attention should be called. It is expected that curiosity concerning these signs might also slow those motorists who read while they drive. The road system was not designed for high-speed travel.

Several scientific visitors spent periods varying from one day to three weeks at the Arboretum. Chief among them were Dr. Charles M. Rick, of the University of California, who was working on a fellowship from the Guggenheim Foundation. The experimental plot, the herbarium, and the orchid-breeding laboratory were all in continuous use for at least two months, so that the Arboretum functioned effectively as a summer biological research center.

Mr. August P. Beilmann continues to be Manager of the Arboretum.

Orchid Department at the Arboretum.—Offspring of some of the English hybrids of the Cattleya group which were purchased in 1939 are sources of increasing flower production. The Cattleya group, along with Cypripediums, Dendrobium, and Phalaenopsis, produced 33,606 individual flowers for the year. A total of 21,345 plants has been repotted into either 4-, 5-, or 6-inch pots, and 10,000 seedlings have been removed from the three hydroponic benches and potted into either 3-, or 4-inch pots. The number of fully developed plants repotted was 26,488. Those of especial value were propagated;

175 community pans were planted from the germinating flasks. To make more space, duplicate material has been sent to the Fairchild Tropical Garden in Miami and to the University of Missouri for use in research work.

A new peat-shredding machine has been developed and installed by Mr. Lowry, resulting in the preparation of a superior potting medium at a considerable saving in labor. The old method was to chop the peat into chunks whereas the new machine will separate the fibers by kneading the peat.

Two orchid houses and the small passage-way leading from the Head House into the Boiler House have been reglazed, representing 4,840 square feet of roof area. These orchid houses were also repainted, and the mullions were sealed with the new type aluminum bar caps.

The station-wagon has made 114 trips between the Arboretum and the City Garden during the year, hauling either cut orchids or plants for display at the City Garden. The panel truck was used particularly during the staging of the orchid show at the City Garden in February.

Mr. Hans Gubler from Zurich, Switzerland, started work August 17 in the orchid laboratory, where he will study methods of germination and the effects of colchicine on orchids.

A worth-while collection of about 1,300 orchid plants and seedlings was presented to the Garden by Mr. H. L. Dillon, of Glen Head, Long Island.

Mr. G. R. Lowry is in charge of the Orchid Department at the Arboretum.

Research and Instruction

Dr. Edgar Anderson, Geneticist to the Garden and Engelmann Professor in the Henry Shaw School of Botany, has continued his studies of hybridization in wild populations and of the history and classification of the varieties of maize. During the year he published one book in each of these fields. "Introgressive Hybridization," a consideration of the dynamics of hybridization, was brought out by Wiley & Sons in their Biological Research Series. A little later in the year the same publishers produced a new edition of the standard text and reference book on maize, "Corn and Corn Growing." Dr. Anderson was one of three authors who rewrote and revised this fifth edition.

During the summer, Dr. Anderson carried on experimental work on maize genetics in Iowa in collaboration with Dr. William L. Brown of the Pioneer Hi-bred Corn Company, and at Gray Summit, where an experimental field was maintained with the help of the Arboretum staff and two graduate students.

Dr. Henry N. Andrews, Jr., Paleobotanist to the Garden and Acting Dean in the Henry Shaw School of Botany, has continued collecting activities in the coal fields of southern Illinois and Kansas. Aided by a grant from the American Philosophical Society, considerable quantities of coal-ball petri-

factions were collected in southern Illinois during June. In the autumn two trips were made in the eastern Oklahoma-Kansas region, resulting in the discovery of one new locality where large quantities of well-preserved specimens were found. This locality presents quite a different aspect from previously studied coal-ball floras; in the initial survey of the specimens new plants have been recognized and the general assemblage is distinct in itself.

Dr. Carroll W. Dodge, Mycologist to the Garden and Professor in the Henry Shaw School of Botany, has spent much of the time available for research in identifying miscellaneous collections sent in by correspondents from Quebec, eastern United States, Kansas, Alaska, the West Indies, Central America, Panama, Brasil, Hawaiian Islands, and a small collection from Heard Island of species previously known only from Kerguelen Island. Routine determinations of cultures of fungi, both human and plant pathogens, have been made for correspondents. Dr. Dodge was appointed Visiting Professor at the Louisiana State University for the summer session where he gave a course in Medical Mycology to about 40 graduate students. The long week-ends were utilized in field work in the southern part of Louisiana. The study of the collections of the U. S. Antarctic Service Expeditions (Admiral Byrd's Third and Fourth Expeditions) has been continued. The usual courses of instruction at Washington University were given.

Dr. Jesse M. Greenman, Curator Emeritus of the Herbarium, has continued his studies on tropical American Senecios.

Dr. Gustav A. L. Mehlquist, Research Horticulturist to the Garden and Professor of Botany in the Henry Shaw School of Botany, has continued to devote the time available for research to investigations on hybridization and cytogenetics of certain plants important in horticulture. In addition to the teaching in the School of Botany, Dr. Mehlquist has taught the two courses in general horticulture and plant propagation offered by the Garden. One course is open to students in Occupational Therapy at Washington University Medical School and the other to any interested amateur. Unfortunately, space in the greenhouses does not permit more than a total of 40 students in the two courses. During the past two years, the number of applicants has far exceeded this number.

Dr. Robert W. Schery, Research Associate at the Garden and Assistant Professor in the Henry Shaw School of Botany, divided his time during the past year between the University and the Garden. At the University he has been engaged in teaching elementary botany, economic botany, and plant materials, and in preparation of manuscript for an "Economic Botany" book and a "Laboratory Outline." At the Garden his activities included assembling materials for the BULLETIN, research on the flora of Panama, studies on the Leguminosae, co-editorship with Dr. Robert E. Woodson on the "Flora of

Panama," and certain public-relations work involving occasional lectures and replies to inquiries. He made several trips into the Ozark region, in the company of Dr. Steyermark and various students, and spoke at the hearings at Newport, Ark., concerning erection of dams on Missouri streams.

Dr. Rolla M. Tryon, Jr., Assistant Curator of the Herbarium and Associate Professor in the Henry Shaw School of Botany, has helped in sending out exchange material and assisted with the organization of certain plant groups in the Herbarium. Special attention was given to the genus Quercus. From the wealth of historical material the types of species named by Engelmann, DeCandolle, Trelease, and others were identified and labeled. A large number of duplicates were withdrawn and set aside for exchange. Research investigations included preliminary surveys of the New World species of Adiantum and of the erect species of the *Selaginella rupestris* group.

Dr. George B. van Schaack, Honorary Curator of Grasses in the Herbarium, pursued special investigations of the Andropogoneae and Hordeae tribes of the grass family.

Dr. Robert E. Woodson, Jr., Curator of the Herbarium and Professor in the Henry Shaw School of Botany, has been particularly active in the reorganization of the herbarium, progress of which is reported elsewhere. He also has had charge of three classes and the supervision of graduate students in the Henry Shaw School of Botany majoring in taxonomy of seed plants. His research activities have been concerned chiefly with the "Flora of Panama" and with various topics in the families Asclepiadaceae and Apocynaceae, particularly Aspidosperma, a large genus of forest trees in tropical America.

Degrees.—At the June 1949 commencement, the degree of Doctor of Philosophy was conferred upon the following: Robert W. Baxter, A.B. and M.A., Washington University (Paleobotany); George A. Llano, A.B., Cornell University, M.A., Columbia University (Mycology); Henry A. McQuade, A.B., Washington University, M.A., University of Missouri (Cytogenetics); and Frederick G. Meyer, B.S. and M.S., Washington State College (Taxonomy).

The degree of Master of Arts was conferred on Dennison H. Morey, A.B., Washington University (Genetics), and David J. Rogers, B.S., University of Florida (Taxonomy).

Graduates and Fellows: The following graduate students and fellows were registered in the Henry Shaw School of Botany in 1949:

Graduate Assistants (half-time graduate assistants): George F. Freytag, A.B., University of Wyoming (Taxonomy); Marilyn Amy Gage, B.S., Pennsylvania College for Women (Genetics); John M. Gillett, B.A., Queen's University, Ontario, Canada (Taxonomy); Marion T. Hall, B.S. and M.S.,

University of Oklahoma (Taxonomy-Genetics); Hugh H. Iltis, B.S., University of Tennessee (Taxonomy); Daniel O. McClary, B.S., Southeastern State Teachers' College, Oklahoma (Microbiology); Dennison H. Morey, A.B. and M.A., Washington University (Cytogenetics); Sidney D. Rodenberg, A.B., Washington University (Microbiology); David J. Rogers, B.S., University of Florida, and M.A., Washington University (Taxonomy); Masashi Yamada, A.B., Washington University (Physiology); Milton L. Zucker, A.B., Washington University (Physiology).

Burmese Government State Scholarship: Ko Ko Lay, B.S., University of Rangoon, M.A., Washington University (Taxonomy).

Henrietta Heerman Scholar: Robert W. Baxter, A.B. and M.A., Washington University (Paleobotany); Reino O. Alava, A.B., Turku University, Finland (Taxonomy); Jonathan D. Sauer, A.B., University of California (Genetics).

University Fellowship: Richard W. Holm, A.B. and M.A., Washington University; Sergius H. Mamay, B.S., University of Akron, M.A., Washington University (Paleobotany); Frederick G. Meyer, A.B. and M.S., Washington State College (Taxonomy).

Special Research Assistantship at Brookhill Farm: Alfred G. Etter, A.B., Washington University (Ecology).

Jessie R. Barr Fellowship: Alice F. Tryon, B.S., Milwaukee State Teachers' College, M.S., University of Wisconsin; Jean Mitchell, A.B., Washington University.

Special Research Grant from Pioneer Hi-Bred Corn Co.: Donald N. Duvick, B.S., University of Illinois (Genetics).

Independent students: John H. Ayers, A.B., Des Moines University, M.A., University of Cincinnati (Mycology); Robert A. Dietz, B.S., Principia College (Ecology); Harrison A. Hoffman, B.S., McKendree College, M.S., University of Illinois (Microbiology); Frank L. Mercer, M.S., University of Michigan, Ph.G., St. Louis College of Pharmacy (Physiology); Henry A. McQuade, A.B., Washington University, M.A., University of Missouri (Cytogenetics).

Published Articles and Books.—

Allen, Paul A., Representative in the Tropics: The Durian—A Fascinating Tropical Fruit. Mo. Bot. Gard. Bull. 37:185–187; Orchidaceae, third and fourth parts, in Woodson and Schery's "Flora of Panama." Pt. III. Fasc. 4 and 5. Ann. Mo. Bot. Gard. 36:1–132, 133–245.

Anderson, Edgar, Geneticist: Gravel Bars Evolve Their Own Flood Control. Mo. Bot. Gard. Bull. 37:54–57; Introgressive Hybridization. 119 pp.; with C. R. Stonor: Maize among the Hill Peoples of Assam. Ann. Mo. Bot. Gard. 36:355–404; with Charles M. Rick: On Some Uses of Maize in the

Sierra of Ancash. *Ibid.* 405–412; with J. J. Newlin and Earl N. Bressman: Revision of Wallace and Bressman's "Corn and Corn Growing." (5th ed.) 424 pp.

Andrews, Henry N., Jr., Paleobotanist: Fossil Tree Ferns of Idaho. Archaeology 1:190–195; Nucellangium, A New Genus of Fossil Seeds Previously Assigned to Lepidocarpon. Ann. Mo. Bot. Gard. 36:479–505.

Baxter, Robert W., Henrietta Heerman Scholar in the Henry Shaw School of Botany: Some Pteridosperm Stems and Fructifications with Particular Reference to the Medullosae. Ann. Mo. Bot. Gard. 36:287–352.

Beilmann, August P., Manager of the Arboretum: Fifteen Years of Erosion Control. Mo. Bot. Gard. Bull. 37:57–63; If Your Soil is Clayey. Horticulture 27:136; Nature was Wrong—Man Dams the Rivers and Solves Most of his Problems. The Washington Missourian. Oct. 13. p. 1. Sect. B.; The Persimmon—A Long-Neglected Fruit. Mo. Bot. Gard. Bull. 37:189–192; Planting and Care of Conifers. *Ibid.* 145–147; The Role of Instruments in Tree Physiology and Diagnosis. Arborists' News 14:67–69; Starved Trees—How to Nourish Them Properly. Park Maintenance 24:8–10; Three Evergreen Barberries. Garden Path 19[1]:11. (Reprinted from March 1949 Garden BULLETIN); Tree Feeding. Mo. Bot. Gard. Bull. 37:115–122. (Reprinted condensed in Wisc. Hort. 39:324).

Brenner, Louis G., of the Arboretum staff: Crawfish Flat. Mo. Bot. Gard. Bull. 37:195–196; Food for Thought, for Quail. *Ibid.* 48–53; with Robert B. Nevins: Beaver Taste in Trees. *Ibid.* 110–114.

Cutak, Ladislaus, in charge of Succulents: Spine Chats. monthly feature in the Jour. Cactus & Succ. Soc. Amer.; A Visit to Mexico's Largest Cactus Establishment—La Quinta. *Ibid.* 21:120–122; A Visit to the Pedregal. Nat. Cactus & Succ. Jour. (British) 4:37–38; What is a Succulent? Jour. Cactus & Succ. Soc. Amer. 21:10–15. (Reprinted from Sept. 1948 Garden BULLETIN, condensed in Wisc. Hort. 39:119).

Etter, Alfred G., Graduate Student, Henry Shaw School of Botany: The Danger of Weed-Killers. The Land 8:177–182; Memoirs of Misuse. Mo. Bot. Gard. Bull. 37:34–40; Wildness, A Succession of Events on Gravois Creek. *Ibid.* 137–143. (Reprinted in The Land 8:319–321).

Kohl, Paul A., Floriculturist: If This is Your Problem, It can be Licked. House Beautiful 91:54–55, 117; Reducing Garden Upkeep. Mo. Bot. Gard. Bull. 37:89–107.

Kuykendall, J. Richard, Student in Horticulture, Washington University: Commercial Orchid Culture in the United States—The Development of an Industry. Orchid Lore. 2[4]:3–11. (Reprinted from Oct. 1948 Garden BULLETIN).; with Harold St. John: Revision of the Native Hawaiian Species of Gardenia (Rubiaceae). Brittonia 6:431–449; with David O. Galey: The Role

of the Korean Hybrids in the Development of the New Hardy Garden Chrysanthemums. Mo. Bot. Gard. Bull. 37:161–178; with David O. Galey and Robert Gillespie: Some Evergreens for St. Louis Gardens. *Ibid*. 147–159.

Lay, Ko Ko, Graduate Student, Henry Shaw School of Botany: A Revision of the Genus Heliocarpus. Ann. Mo. Bot. Gard. 36:507–541.

McQuade, Henry A., Graduate Student, Henry Shaw School of Botany: The Cytology of *Paphiopedilum Maudiae* Hort. Ann. Mo. Bot. Gard. 36:433–473.

Mehlquist, Gustav A. L., Research Horticulturist: The Culture of Cypripediums. Orchid Dig. 13:378–380; Delphiniums. Mo. Bot. Gard. Bull. 37:93–100; The Formosa Lily. *Ibid*. 101–103; Modern Cymbidium Hybrids —What Makes Them Superior? Cymbidium Soc. News 4:1–12; The Role of Genetics in Floriculture. Fl. Exch. 113^{14}:21, 25, 54–57, and South. Flor. & Nurseryman 62^{28}:13, 46–49, 99–102; The Significance of Chromosome Numbers in Orchid Breeding. Am. Orchid Soc. Bull. 18:284–293; Why Do Chrysanthemums Bloom in the Autumn? Mo. Bot. Gard. Bull. 37:178–184; Role of Genetics in Floriculture. Fl. Exch. 113^{14}:21, 25; with Rauhollah Rahmani: Inheritance of Resistance to Rust in the Snapdragon. Proc. Am. Soc. Hort. Sci. 52:481–486.

Morey, Dennison H., Jr., Graduate Assistant, Henry Shaw School of Botany: How to Make an Aluminum Greenhouse Bench. Flower Grower 36:670. (Reprinted from June 1948 Garden BULLETIN).

Mundkur, Balaji D., Graduate Student, Henry Shaw School of Botany: Evidence excluding Mutations, Polysomy, and Polyploidy, as Possible Causes of Non-Mendelian Segregation in Saccharomyces. Ann. Mo. Bot. Gard. 36:259–280; Morphology and Cytology of Development of the Sex Organs of *Phytophthora himalayensis* Dastur. Bot. Gaz. 110:475–486.

Nevins, Robert B., Student in Botany, Washington University: A Neglected Ornamental for the St. Louis Area. Mo. Bot. Gard. Bull. 37:109–110; with Louis G. Brenner: Beaver Taste in Trees. *Ibid*. 110–114; with R. W. Schery and Jean Mitchell: Laboratory Guide in Elementary Botany for Study of the Plant Kingdom. Educational Publ. Dec. 1949.

Pavcek, Paul L., Associate Professor of Microbiology, Washington University: The Fermentation Industries. Mo. Bot. Gard. Bull. 37:201–206.

Pring, George H., Superintendent: Grow Tropical Water-lilies. Horticulture 27:219, 235–236; Historic Daniel Boone Tree Survives. South. Flor. & Nurseryman 61^{14}:32–33. (Reprinted from Dec. 1948 Garden BULLETIN); *Oncidium Powellii.* Gard. Chron. [British] 126:7–8, and Orchid Rev. 57:159. (Reprinted from April 1937 Garden BULLETIN); Propagation of Tropical Water-lilies. Prof. Gard. 1:190–191; Water-lilies. Mo. Bot. Gard. Bull. 37:65–88.

Rodenberg, Sidney, Graduate Student, Henry Shaw School of Botany: and Masashi Yamada: Wonder Drugs. Mo. Bot. Gard. Bull. 37:206–213.

Rogers, David, Graduate Student, Henry Shaw School of Botany: Stegnosperma: A New Species and a Generic Commentary. Ann. Mo. Bot. Gard. 36:475–477.

Schery, Robert W., Research Associate: A First Record for the Genus Qualea (Vochysiaceae) from North America (Panama). Ann. Mo. Bot. Gard. 36:285–286; Manicoba and Mangabeira Rubbers. Econ. Bot. 3:240–264; Notes about Lower Plants. Mo. Bot. Gard. Bull. 37:214–216; Problems Associated with the Procurement of Plant Products from the American Tropics. Econ. Bot. 3:413–427; A Prolonged Spring for 1949? Mo. Bot. Gard. Bull. 37:104–105; Recent Advances in Wood Technology. *Ibid.* 122–127; Soil Microorganisms, Earthworms, and Man. *Ibid.* 134–137; Supplementary Notes [on Durian]. *Ibid.* 187–189; Watering the Home Lawn. Plants and Gardens 4:208–210. (Reprinted from June 1948 Garden BULLETIN); Winter Adventure with Missouri Springs. Post-Dispatch, Dec. 31, 1948, and Student Life, Dec. 16, 1949. (Reprinted from Dec. 1948 Garden BULLETIN); with Ellen M. Kern: Laboratory Outline for Elementary Botany, revised 3rd printing. Educational Publ., Oct. 1949; with R. B. Nevins and Jean Mitchell: Laboratory Guide in Elementary Botany for Study of the Plant Kingdom. Educational Publ., Dec. 1949.

Tryon, Alice F., Graduate Student, Henry Shaw School of Botany: Spores of the Genus Selaginella in North America, North of Mexico. Ann. Mo. Bot. Gard. 36:413–431.

Tryon, Rolla M., Jr., Assistant Curator of the Herbarium: Some Woodsias from the North Shore of Lake Superior. Amer. Fern Jour. 38:158–170.

Woodson, Robert E., Curator of the Herbarium: with David Azumbuja: New Apocynaceae of South America. Ann. Mo. Bot. Gard. 36:543–548.

Yamada, Masashi, Graduate Student, Henry Shaw School of Botany: with Sidney Rodenberg: Wonder Drugs. Mo. Bot. Gard. Bull. 37:206–213.

Scientific and Popular Lectures.—

Dr. Edgar Anderson: Jan. 4, before Oficina de Estudios Especiales, Mexico City, Mexico, "El Pedunculo del Maíz"; Feb. 11, Southern Illinois Normal University, Carbondale, genetics seminar, "Hybridization", and botany seminar, "The Classification of *Zea Mays*"; March 17, botany seminar, University of Indiana, "Races of *Zea Mays*"; March 13, Greater St. Louis Flower Show, "Herbs"; *Rosa alba:* April 16, over Station KFUO, May 2 and May 9, at the City Art Museum, Sept. 16, Rose Society of Greater St. Louis, and Nov. 1, regional meeting of the Federated Garden Clubs.

Mr. August P. Beilmann: Jan. 7, before the St. Louis Horticultural

Society, "Foundation Plantings"; Jan. 11, Franklin Co. chapter of the Conservation Federation of Missouri, "Sedimentation of Reservoir Pools"; Feb. 17, Midwestern Chapter National Shade Tree Conference, Chicago, "The Role of Instruments in Tree Diagnosis"; April 18, Lions Club, Union, Mo., and May 7, Big River Protective Association, Ware, Mo., "Flood Control"; April 21, Talking Leaves Garden Club, Brentwood, and April 27, Daleth Study Club, "Walk through the Wild Flowers"; April 30, Friends-of-the-Land seminar at Waynesville, Mo., "Brush Creek as a Flood Control Laboratory"; May 27, Civitan Club, "Trees"; Sept. 7, Rotary Club of Kirkwood, "Brush Creek as a Conservation Yardstick."

Mr. Ladislaus Cutak: Jan. 9, before Henry Shaw Cactus Society, "Introducing the Fascinating Bromeliads"; Feb. 28, Little Gardens Club, "Four Seasons in Shaw's Garden"; March 6, Henry Shaw Cactus Society, "Arizona—The Cactus Wonderland"; March 15, Gardeners' Workshop, St. Louis Flower and Garden Show, and March 31, Rock Community Garden Club, at Arnold, Mo., "Culture, Care, and Propagation of Cactus"; March 17, the Garden Club of St. Charles, Mo., "Cacti and Succulents"; "Mexico in Kodachrome": March 18, Clayton Garden Club, April 19, Business & Professional Women's Club of the Y.W.C.A., May 3, Catholic Women's Association, June 3, St. Louis Horticultural Society, Sept. 12, Men's Garden Club of Webster Groves, and Sept. 22, Women's Club of Hamilton Ave. Christian Church; May 3, Collinsville, Ill., Woman's Club, "Exploring Mexico's Wilderness"; May 8, Henry Shaw Cactus Society, "The How and Why of Cactus Grafting"; July 3, Third Biennial Convention of the Cactus and Succulent Society of America, at Phoenix, Arizona, round-table discussions on "Cacti and Succulents"; Oct. 11, St. Louis-St. Louis County Beekeepers' Association, "Bee Plants in Mexican Deserts"; Nov. 13, Henry Shaw Cactus Society, and Nov. 20, Webster Groves Nature Society, "Canyon Treks and Desert Trails in the Southwest."

Mr. Paul A. Kohl: Feb. 23, before Brentwood Garden Club, "Roses"; March 1, Nurserymen's School, "Succession of Bloom"; March 22, Garden Club of St. Louis, "Hemerocallis and Peonies"; March 23, Talking Leaves Garden Club, and March 24, Webster Groves Garden Club, Group IV, "Roses"; April 1, St. Louis Horticultural Society, "Annuals and Perennials"; April 19, Sutton School Parent-Teacher's Association, Maplewood, "The Missouri Botanical Garden"; April 27, Mackenzie Park Women's Club, "Gardening"; June 10, Webster Groves Garden Club, Group XII, Oct. 21, Clayton Garden Club, and Nov. 10, Concord Garden Club of Sappington, "Roses"; Nov. 11, the Greater St. Louis Dahlia Society, "Chrysanthemums."

Dr. Gustav A. L. Mehlquist: Jan. 19, Commercial Flower Growers of Chicago, "Carnation Growing"; Jan. 24, Little Gardens Club of Clayton,

"Plant Propagation"; March 28, Orchid Society of Southern California, Los Angeles, "Cypripedium Culture"; March 31, Cymbidium Society, Pasadena, "Modern Cymbidium Hybrids—What Makes Them Superior?"; April 1, horticultural seminar, University of California, Los Angeles, "Polyploidy in Orchids"; April 4, San Diego Orchid Society, and April 6, Santa Barbara Orchid Society, Calif., "Chromosome Numbers in Orchids and their Significance in Breeding"; April 15, Better Gardens Club, "Garden Delphiniums"; May 27, Pine Tree Garden Club, "Factors that Influence the Growing of Plants"; June 13, convention of Missouri State Florist Association, Excelsior Springs, "The Production of New Varieties through Hybridization"; July 15, Rose Society of Greater St. Louis, "Soils and Fertilizer Problems in Growing Roses"; August 1, convention of the American Society of Florists, "The Application of Genetics to Floriculture"; Sept. 21, Hawbrook Garden Club, and Sept. 26, Little Gardens Club of Clayton, "Pruning Shrubs and Trees"; Nov. 2, All Jersey Florist Convention, "Tailor-made Plants."

Mr. George H. Pring: Jan. 13, before the St. Louis Florists' Club, Jan. 18, Richmond Heights School, Feb. 11, Webster Groves Garden Club, "Gardens in England"; Feb. 16, Ladue School, "Use of Dogwood in Planting"; April 8, dedication address at the Webster Park Arbor Day Exercises, April 12, Rotary Club of Maplewood, "England after the War"; April 19, Parent Teachers' Assn. Lincoln School, St. Louis County, and April 22, Southhampton Presbyterian Church, "English Gardens"; April 28, Alpha Delta Chapter of Beta Sigma Phi, Oct. 20, Beta Chapter of Nu Phi Mu, and June 1, Women's Assn. of Richmond Heights Presbyterian Church, "Mr. Shaw's Garden"; May 4, Supervisor's Club of Monsanto Chemical Co., and Nov. 4, Fellowship Society, Pilgrim Ev. Lutheran Church, "Four Seasons in the Garden"; "Visiting English Gardens": May 4, Garden Study Club of the Tri-City Y.M.C.A., Granite City, Ill., May 9, Parent-Teachers' Assn., Riverview Garden District, Baden Station, Oct. 13, Shiloh Valley Garden Club, Shiloh, Ill., May 19, West Presbyterian Church, Nov. 1, Woman's Club, Collinsville, Ill., Nov. 14, Men's Garden Club of Webster Groves, and Dec. 2, Webster Groves Garden Club, VIII; Dec. 5, Traffic Club of St. Louis, "Mr. Shaw's Garden"; Aug. 9, Belleview Park Improvement Assn., Bel-Nor Grade School, "Selecting Trees and Shrubs to Plant in Your Garden"; Sept. 12, American Orchid Society Meeting, Cleveland, Ohio, "Mimicry of Orchid Flowers"; Oct. 25, Tree Loving Group, "Rare Trees in the Garden."

RESEARCH IN HORTICULTURE

Chrysanthemums.—Selected seedlings from previous years were subjected to further greenhouse trials in order to ascertain which seedlings should be retained for further studies.

Delphinium.—Hybridization between the red-flowered *Delphinium cardinale* Hook. and garden forms of *D. elatum* L. has been continued. During the spring and early summer more than 2,000 flowers were hand-pollinated. This number of pollinations is the potential equivalent to about 50,000 seeds. However, owing to hybrid sterility, only about 5,000 seeds were obtained, most of which did not contain embryos.

In order to increase the number of seedlings from the more important plants, the majority of the seeds were embryo-cultured on agar to which the necessary nutrients had been added. Although the number resulting by the use of this method was not materially greater than with the usual method of planting in soil, it has certain advantages. In the process of embryo-culturing it was possible to get a better knowledge of the quality of the seeds and correlate this information with the plant from which the seed was obtained. The fact that more than half of the seeds did not contain embryos gave a partial answer as to why germination had been so poor in certain lines in previous years. Furthermore, by embryo-culturing it was possible to plant practically the entire crop of seeds in a six-cubic-foot refrigerator. As relatively low temperatures favor germination in Delphinium, it was possible to plant the seed earlier than the high outside temperatures would permit. As far as time allows, cytological studies are being made on the more important lines and hybrids. While some lines are brought to an end through complete sterility, a sufficient number possess enough fertility to permit the continuation of the project, each generation bringing the prospect of a good red-flowered perennial delphinium a little closer.

Another problem of delphinium breeding is also being actively investigated. *D. Belladonna*, a widely grown garden hybrid, is thought to have originated from a cross between *D. elatum* and some member of the *D. cheilanthum-grandiflorum* complex. Some hybrids made here between *D. elatum* and *D. grandiflorum* var. *chinense* strongly resemble the present-day Belladonnas, but are triploid and sterile instead of hexaploid and fertile as are most Belladonna types. With the assistance of Miss Amy Gage attempts are now being made to double the chromosome number in these hybrids to see if fertile strains of the Belladonna type can be developed.

Dianthus.—The research on inheritance in carnations is being continued. Triploid and tetraploid lines are studied both from a genetic and a cytological point of view. Certain pure-breeding diploid lines of known genotypes are being increased to provide material for further studies on the nature of the flower pigments involved.

Orchids.—Genetic and cytological studies of orchids are being continued. During the past year the chromosome numbers and cytological behavior of many species and hybrids have been investigated. It is becoming increasingly

clear that polyploidy has been very important in the development and production of many of our most valuable hybrids. There is no question but that this information will be of value in planning further developments in orchid breeding.

Research in Horticulture is in charge of Dr. Gustav A. L. Mehlquist.

THE HERBARIUM

During the past year 22,500 sheets of dried plants were mounted and inserted in the herbarium, bringing the estimated total to 1,575,923 mounted specimens.

Within the same period 22,119 herbarium specimens were accessioned for future insertion, of which 1,612 were purchased and 423 obtained as gifts. A total of 20,084 specimens was received through exchange with other institutions, to which the Garden sent out 24,379 specimens. Particularly noteworthy amongst these recent accessions to our herbarium are a set of 2,545 specimens collected by Hassler in Paraguay and a wide selection of 3,723 plants from various parts of Africa.

The Garden received requests for the loan of 4,177 herbarium specimens from sixteen institutions of the United States and from eight foreign botanical laboratories. In the same period the Garden borrowed for the use of its staff and students a total of 2,430 specimens from seven domestic and seven foreign herbaria.

Maintenance activities in the herbarium have been particularly heavy during the past year, since the professional staff has been quite inadequate until recently. However, the year 1949 has witnessed a most encouraging advance in the mounting and insertion of specimens, in the organization of disorderly sections of the herbarium, and in the improvement of exchange balances with other botanical establishments. In addition to such activities on behalf of our own collections, our herbarium staff has answered hundreds of questions concerning plant materials sent to us for examination and naming.

MISSOURI BOTANICAL SURVEY

During 1949 seven plant species, previously unknown from Missouri, were collected. They are *Robinia hispida* (established in woods) from Platte Co., *Euphorbia Esula* from Chariton Co., *Campanula aparinoides* from Shannon Co., *Scirpus Hallii* and *Eupatorium hyssopifolium* from Howell Co., *Potamogeton epihydrus* var. *Nuttallii* from Reynolds Co., and *Callicarpa americana* from Ozark Co. The last species, a shrub known as Beauty-berry or French Mulberry, and greatly admired for its showy clusters of rich purple berries, has been previously sought in the state by earlier collectors. In its present and only known Missouri station, along the White River in Taney

Co., near the Arkansas line, it will be completely exterminated by the impounding of the waters of the Bull Shoals Dam. Several color forms of species, new to the state and to science, were also discovered.

Special botanical study was devoted to areas that will become inundated through dam erection, causing permanent loss of record of the original vegetation. For example, Squirrel Corn *(Dicentra canadensis)*, was found in southern Missouri at only one locality, in Taney Co. along White River, and it will be destroyed by the Bull Shoals Dam. The same dam will destroy a large native stand of Cucumber Tree *(Magnolia acuminata)* in Ozark Co., and many other rare species.

In early spring, the remarkable endemic Missouri genus, Geocarpon, known nowhere else in the world, was re-collected for the second time by its original collector, Mr. E. J. Palmer. In restudying this plant, certain morphological characters in the flowers, previously overlooked, have been found affecting its taxonomic position.

The following species, known previously in the state from but one locality, were collected this year from a new county: *Echinodorus tenellus* from Howell Co. (discovered in St. Louis Co. by Engelmann in 1845 and not since found); the yellow form of the columbine *(Aquilegia canadensis* f. *flaviflora)* from Clay Co. (previously collected from Buchanan Co. in the middle of the last century); *Juncus balticus* var. *littoralis* from Johnson Co.; the black-fruited form of the persimmon from Benton Co.; *Thlaspi perfoliatum* from Taney Co.; and the deep rose-colored form of the flowering dogwood *(Cornus florida* f. *rubra)*.

Other noteworthy occurrences were the following: finding *Corallorrhiza Wisteriana* in flower March 29, the earliest date yet recorded for a native orchid; obtaining the first flowering material in Missouri of the rare shrub, *Lindera melissaefolium*, to complete the study of this species; discovery of numerous ox-bow lakes covered with Lotus *(Nelumbo pentapetala)* in northern Missouri (Grundy Co.), which will be destroyed by the proposed Chillicothe Dam; discovery of a Grama Grass *(Bouteloua gracilis)* on a natural sandy prairie in Clark Co., northeastern Missouri, a species previously known in the state only from the loess mounds of northwestern Missouri; and finding an area of rich dissected ravines in northern Missouri (Sullivan Co.), teeming with numerous ferns, orchids, and other rare plants; here abounds Bracken Fern, previously known in the state only from the Ozark area.

The survey is being conducted by Dr. Julian A. Steyermark, Research Associate to the Garden and Associate Curator of the Herbarium, Chicago Natural History Museum.

THE LIBRARY

The last year has been spent largely in catching up on routine library work—cataloguing, entering the incoming and outgoing books and periodicals, bibliographic and reference work, checking catalogues for wanted items, etc. Also, the library collaborated in two important serial lists: the third edition of the "Union List of Serials," and a list of periodicals in the Washington University libraries. With only two full-time assistants, time could not be found to take part in the latter project without outside help, and a librarian was sent from the University who spent two months in listing the Garden periodicals. Checking of lists is always constructive in that it constitutes more or less of an inventory, keeping the library up to date on new publications, on lost or missing volumes, and need for cross references.

In addition to the help given in reference work to staff-members and students in the Garden and the Shaw School of Botany, the library is being called on constantly by botanists from other institutions for verification of references, transcripts of pages, etc. Frequently reproductions of pages or illustrations are desired, and since there is no photostatic equipment in the library nor any room for it, one of the librarians must take the books downtown for the pages to be reproduced. Books are also loaned outside the Garden on the interlibrary loan plan, 206 books having been borrowed by outside institutions during the year.

In June the librarians assisted in assembling the exhibits for several of the windows in the Boatmen's National Bank Building, showing the activities of the Missouri Botanical Garden.

In September Mrs. Eloise Enzinger Fay, who recently graduated from Washington University, was employed as an assistant. Having majored in botany she was already familiar with the Garden library and was able to begin her duties with the minimum of training. With her help many seed and nursery catalogues and experiment station bulletins have been catalogued and shelved, and a start has been made in making an inventory of the books in the folio room.

Garden Publications.—The work in connection with issuing and sending out the Garden publications is done by the library staff. The librarian edits and proofreads the manuscripts, indexes the volumes, etc., and one of the assistant-librarians tends to the exchanges and sales. The cash receipts during the year for all the Garden publications, including reprints, "Flora of Missouri," post-cards of Garden views, etc., were $6,328.00.

Volume XXXVI of the quarterly ANNALS and volume XXXVII of the monthly BULLETIN were issued during the year. The volume of the ANNALS contains 554 pages, 41 plates, and 81 text-figures. The February and May

numbers constitute the last fascicles of the Orchidaceae family in Woodson and Schery's "Flora of Panama," and include an Index to the Panamanian Orchids. Three doctors' theses were published in the ANNALS during the year, and one master's thesis. About half of the ANNALS edition is sent to other institutions in exchange for their publications. The foreign shipments are sent through the Smithsonian Institution, but at present shipments are not being sent to China nor outside the American and British zones in Germany. No Russian publications are now being received in exchange, but seven institutions are subscribing to the ANNALS and bills are received for the few Russian journals sent us.

The BULLETIN contains 224 pages and numerous illustrations. Two feature BULLETINS were published during the year—an entire number on "Conservation" and one on "Water-lilies," the latter containing colored plates of some of the Nymphaea hybrids originated by Mr. Pring. The greater part of the BULLETINS printed are sent to "Friends of the Garden."

Library Accessions.—Numerous book catalogues have been carefully checked, but very few of our *desiderata* were advertised. Two collections were received as gifts, one from Mr. George E. Kessler of Kansas City, consisting of 67 books and pamphlets on landscape architecture, and a collection of 41 books on botany from the Washington University Medical School. Through Dr. Killip and Dr. Walker, of the Smithsonian Institution, the Garden obtained a very rare and valuable botanical work—a photostatic reproduction of Wallich's "Catalogue of Asiatic Plants," one of the seven copies made by Dr. Maxon, of the Smithsonian Institution, from the manuscript in the Linnean Society of London. Worthy of mention too are Pallas' "Species Astragalorum," a large folio work on legumes published in 1800 and containing numerous colored plates, and Lonicerus' "Kreuterbuch," probably the 1573 edition. The latter may be a valuable rarity, but we have no definite information as yet.

In an effort to build up the map collection, the following maps and geographical works were purchased during the year: Bohun's Geographical Dictionary (1695); The London Times Survey Atlas of the World; Chauchard's General Map of Germany, Holland, Netherlands, etc. (1800); Webster's Geographical Dictionary; Rand-McNally's Atlas of the World; Raisz's General Cartography; Kitchin's Universal Atlas (1795); Stanford's London Atlas of Universal Geography; Colton's Map of Missouri (1859); and Conway's Diagram of the State of Missouri (1859).

Other accessions, in addition to the current works one would expect to find in a botanical library, were the following: Galloe's, Natural History of English Lichens, parts I–VII; Hernandez, Historia de los Plantas de Nueva España, 1942 (a reissue of the sixteenth-century work, published by Univ.

Nac. Mexico Inst. Biol.); Hutchinson's British Flowering Plants; Indian Phytopathology (new serial); Journal of New Zealand Institute of Foresters; Bulletin Pacific Orchid Society of Hawaii; Sirén's Gardens of China; Robyn's Flore des Spermatophytes de Parc National Albert II.

Statistical Information.—There have been donated to the library or received in exchange for our publications during the year 606 books valued at $2,008.55, and 2,014 pamphlets valued at $353.73. The purchases consisted of 173 books bought at a cost of $1,917.34, and 61 pamphlets and parts of volumes at a cost of $270.58. Three maps were bought at a cost of $7.10, and two were donated. One manuscript and one microfilm roll of the Brazilian publication "Vellosia" were donated. The library now contains 59,078 books and 102,002 pamphlets, and 337 manuscripts. The number of index cards now totals 1,124,883, of which 5,247 were added during the year, 860 having been written by Garden employees and 4,473 purchased at a cost of $127.78. Eighty-six cards were discarded. There were 155 books bound or repaired during the year.

ANNUAL BEQUESTS

The Annual Flower Sermon "On the goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom," provided for in the will of Henry Shaw, was preached at Christ Church Cathedral, on Sunday, May 22, by the Rev. Charles W. Gilkey, until his retirement Dean of the Chapel at the University of Chicago.

The Gardeners' Banquet Fund was used to provide turkeys for the employees at Christmas.

ATTENDANCE FOR 1949

(Not including visitors to Arboretum)

	Week-days	*Sundays*
January	1,854	2,619
February	8,970	8,094
March	4,692	4,499
April	11,703	11,314
May	15,973	12,208
June	11,552	6,002
July	12,064	7,163
August	12,251	4,499
September	15,972	12,208
October	11,554	12,109
November	12,360	17,289
December	4,754	3,754
	123,699	102,258
		123,699
Total		225,927

Respectfully submitted,

GEORGE T. MOORE, *Director.*

THE MISSOURI BOTANICAL GARDEN

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MISSOURI BOTANICAL GARDEN BULLETIN

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Volume XXXVIII February, 1950 Number 2

Cover: Water being poured from a full-grown pitcher of *Nepenthes dyeriana*. Photograph by Ladislaus Cutak.

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Please: Do not discard a copy of the Bulletin. If you have no further use for yours pass it along to a friend or return it to the Garden. Return postage will be guaranteed.

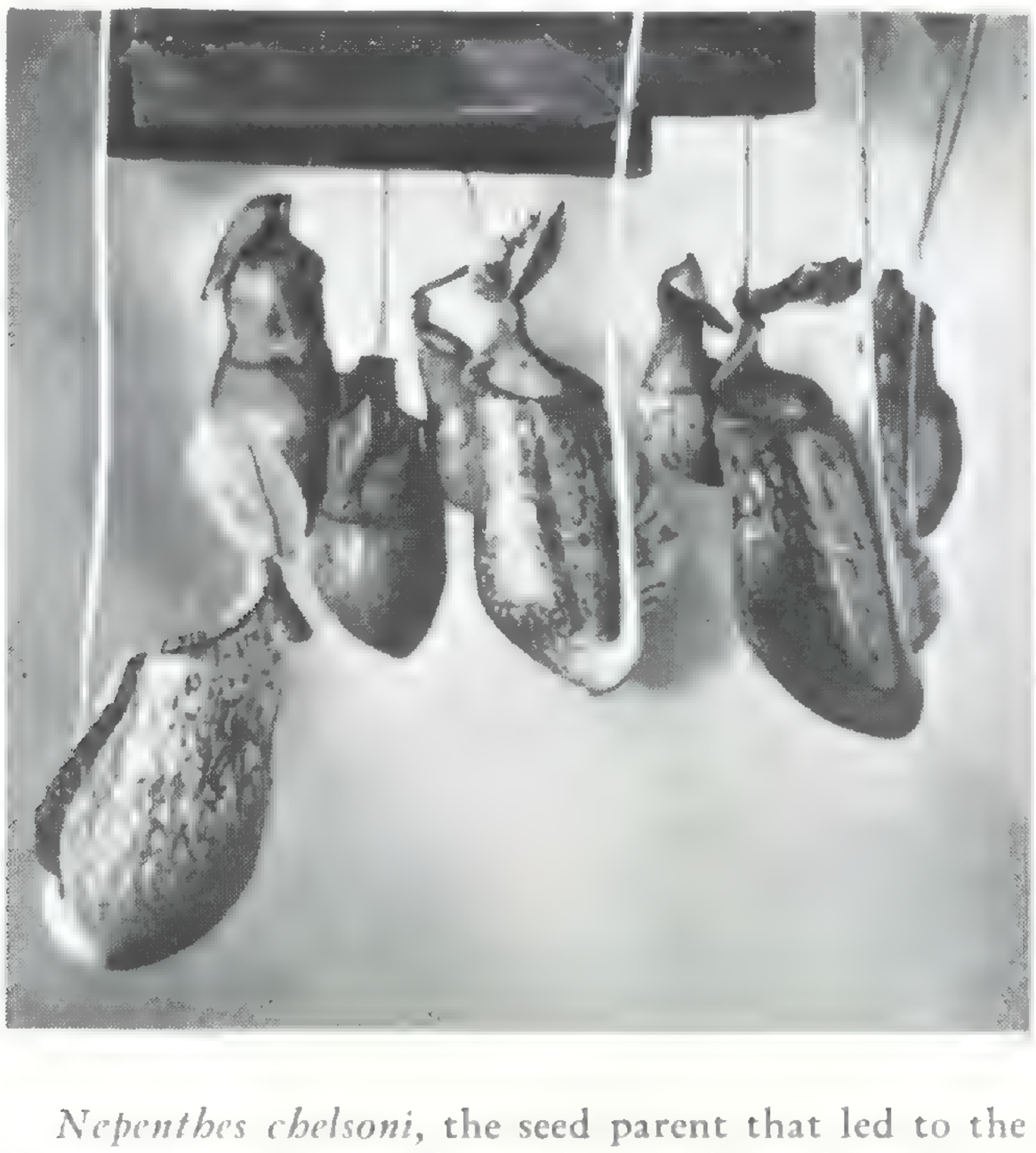
Missouri Botanical Garden Bulletin

Vol. XXXVIII FEBRUARY, 1950 No. 2

NEPENTHES AT THE GARDEN

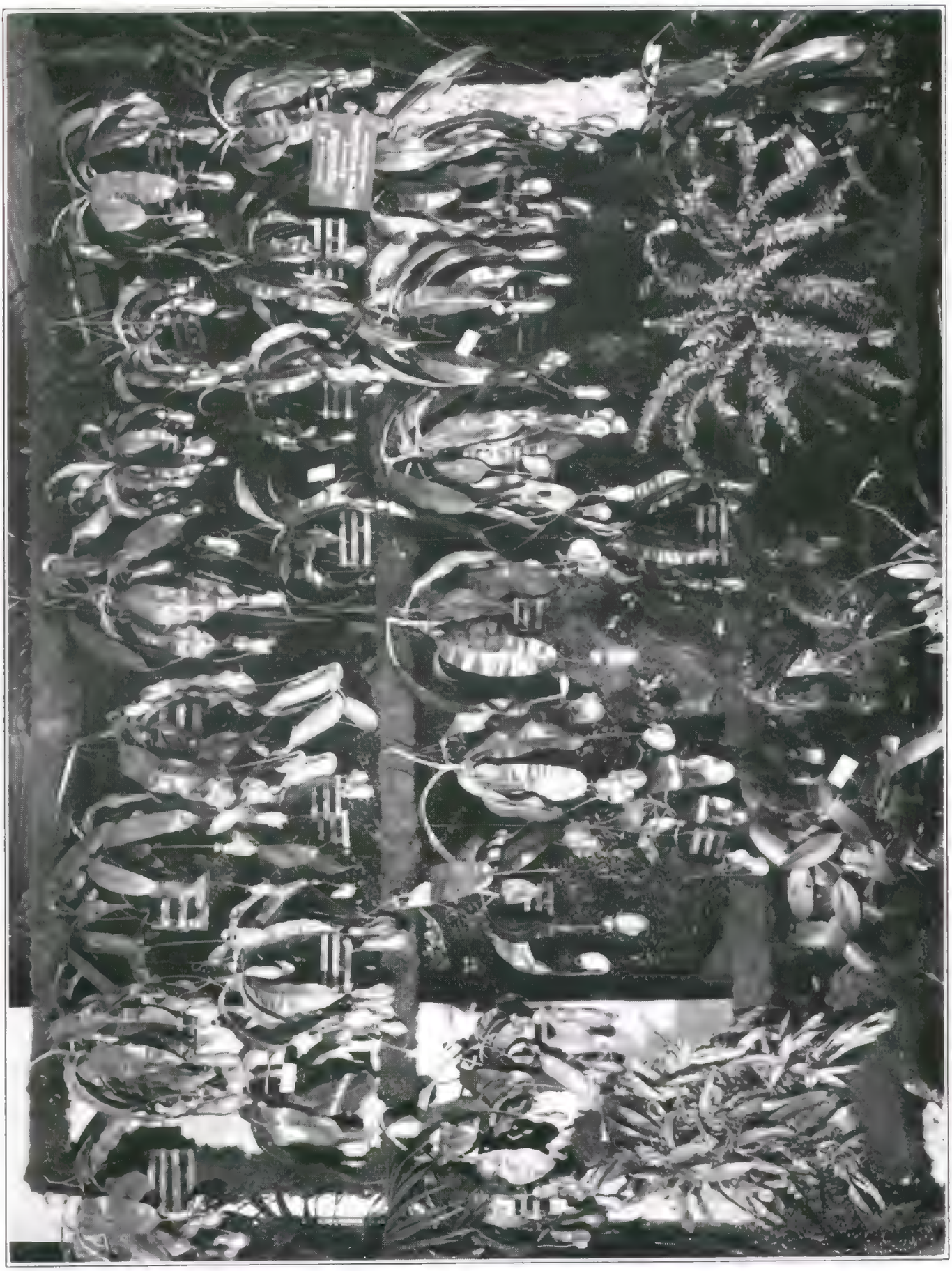
GEORGE H. PRING

One of the most curious groups in the plant kingdom are the Nepenthes or Pitcher-plants, and the Garden is credited with possessing the outstanding collection of such plants anywhere. The writer was convinced of this fact when visiting Europe in 1948. The nucleus of the Garden collection was about a dozen plants received in 1918 as a bequest from the late Mr. D. S. Brown, of Kirkwood, Mo. Through hybridization of these clones we now have over a hundred specimens, many of which are new types.



Nepenthes chelsoni, the seed parent that led to the development of the clones described in this article.

Private collections of hothouse plants, particularly in England, have for years featured Nepenthes as a curious insect-eating plant. In fact, no collection of plant curiosities was complete without them. The Royal Botanic Gardens at Kew, England, has always maintained a special Nepenthes House.



GARDEN'S EXHIBIT OF NEPENTHES AT A NATIONAL FLOWER SHOW

Nepenthes dominii, the male parent of the new Garden hybrid clones.

The continued bombing of London, during World War II, and subsequent lack of coal, experienced help, etc., have resulted in the loss of many of their best collections; hence, it is very fortunate that the Garden has been able to maintain these unusual plants.

The flowers of the pitcher-plants are not conspicuous either in color or size. It is the leaves that make the plant such a curiosity. The prolonged midrib of the leaf is spirally twisted and expanded at the end into an appendage termed a pitcher. Most Nepenthes are climbers and support themselves by this midrib which acts as a tendril before the pitchers develop. The pitchers vary greatly in shape and size, sometimes even on the same plants, and may be either green, yellow, reddish, or purplish in color. The rim is thickened and corrugated and serves not only to strengthen and keep the mouth of the pitcher distended but also secretes a nectar. It may even develop into a funnel-shaped tube projecting into the pitcher to prevent the

escape of the imprisoned insects. On the outside of the pitcher, from the rim to the base, there is usually a ridge bordered with long hairs or bristles. Before the pitcher is fully developed the lid to the mouth is closed, but later it is permanently open and serves as an umbrella to keep out the rain. It is not true, as is sometimes stated, that the lid closes when an insect enters the pitcher.

The interior of the pitcher is covered with numerous glands which secrete a fluid comparable to the gastric juice of the stomach. The nectar on the under-side of the lid and on the corrugated rim entices the insects to enter the pitcher. There they are drowned in the liquid which partly digests them.

BREEDING NEPENTHES

The breeding of new Nepenthes has been the work mainly of European hybridists. Possibly the earliest was Dominy of Veitch & Sons, of London, who first attempted to develop new forms about 1860. He was followed by Court, Tivey, Lindsay and Gautier in Europe. Very little has been done in this country, although Siebrecht & Sons, nurserymen of New Rochelle, N. Y., introduced two or three types.

Since Nepenthes are dioecious (unisexual, with male and female flowers on separate plants), it becomes necessary for the breeder to have duplicate parent plants, such as the Garden has in its collection. When plants are grown for their pitchers annual pruning is necessary to obtain new growth. This occurs at the expense of flowering. When they are grown for breeding they are allowed to assume their normal climbing habit and to produce flowering spikes. Intercrossing demands patience of the hybridist, who must wait for

Director George T. Moore

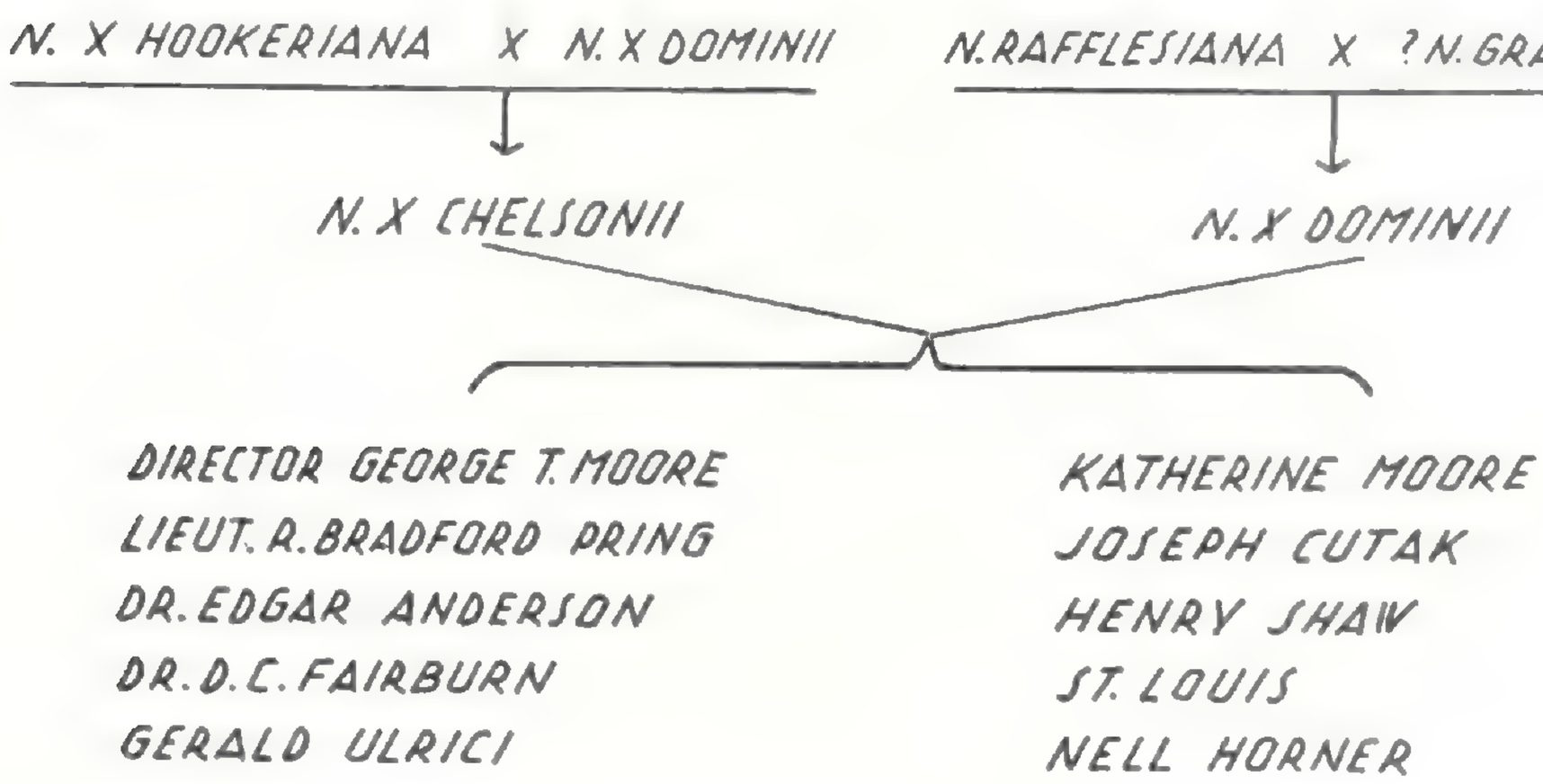
Lt. R. Bradford Pring

ST. LOUIS

DR. D. C. FAIRBURN

male and female plants to be in bloom at the same time. Observations in our collection for a number of years show that male flower spikes are definitely more frequent.

The first pollinations of pitcher-plants at the Garden were made by the writer in 1943 at which time both male and female plants were in flower. Readers are referred to the November Garden BULLETIN (Vol. 31, 1943), in which a discussion of the propagation, culture, and other details was published. Between forty and fifty young seedlings were grown from seeds of the original crosses and at the present time have progressed sufficiently to develop their normal pitchers. The following clonal hybrids raised at the Garden have been selected and described according to the lineage shown in the following chart.



RED PITCHER TYPES

DIRECTOR GEORGE T. MOORE.—Pitchers subcylindric, 5 inches long, 2 inches broad at base, 1½ inches above, purplish-red with green marmorations; pitcher wings prominent, ¾ inch broad, same color and markings as the pitchers, marginal spines purple; rim prominently purple-lined, darker toward lid; lid green-spotted. Leaves 16–18 inches long from the base of the blade to the extended pitchers, blade 2–2½ inches wide.

LIEUT. R. BRADFORD PRING.—Resembles its parent *N. chelsoni* in being very strong-growing. Pitchers pear-shaped, 6–7 inches long, 2–2½ inches broad in the basal portion, 1½–2 inches above, reddish-purple at first, showing green marmorations with age; pitcher wings prominent, with long purple hairs of the same shade as the pitchers; rim very dark reddish-purple; lid reddish-purple with darker spots on the under-side. Leaves to extended pitchers 20–24 inches long, blade 2⅓–3 inches broad; petiole 10–12 inches long.

KATHERINE MOORE.—Pitcher without the typical neck, shaped somewhat like a short barrel, 3½ inches high, lower half 2 inches in diameter, upper 1½ inches, blood-red spotted green, rim reddish with irregular darker stripes, lid purple-red, greenish toward the margin, pitcher wings prominent with marginal spine-like hairs ¼ inch long. Leaves to extended pitcher 16 inches long, 3¾ inches wide, midvein of blade purple.

KATHERINE MOORI

ST. LOUIS.—Pitchers pear-shaped, dark blood-red when young, lighter in age, sparsely green-mottled, 4 inches long, 2 inches wide at base, 2½ inches wide above; pitcher wings prominent, green, mottled reddish-purple, ¼–½ inch broad; marginal spines prominent; rim deep purplish-red toward lid; lid green-spotted and splashed with purple. Leaves 18–22 inches long, blades 2–3 inches wide.

GERALD ULRICI

GREEN PITCHER TYPES

DR. EDGAR ANDERSON.—Pitchers cylindric, with long neck, 5–6 inches long, 1½–2 inches wide at base, 1½ inches above, light green flushed with pink; pitcher wings prominent at base, practically spineless, lids and rim green. Leaves to extended pitcher 18–20 inches long, blade 3–4 inches wide.

DR. D. C. FAIRBURN.—Pitcher subcylindric, 4–5 inches long, 1½ inches in diameter, ridged above the middle, pale green flushed with pinkish toward the top; pitcher wings narrow, margins practically spineless, rim red, green

HENRY SHAW

toward the lid; lid green with slightly colored veins. Leaves to extended pitcher 20–22 inches long, width of blade 3–3 ½ inches.

GERALD ULRICI.—Vigorous-growing plant. Pitchers large, 6 inches high, 3 inches wide at the swollen base; neck 3 inches high, 1¾ inches wide, pale green with reddish veins; pitcher wings prominent, ½ inch wide, greenish in the lower portion, pinkish toward the rim, marginal hairs ⅛ inch long; lid suberect, spotted red below, above with red veins, terminating in a green spur ½ inch long; rim pea-green and corrugated. Leaves leathery, extending 24–28 inches in length, blade 3 inches wide, 16–17 inches long; petiole 10–12 inches long. Stem mottled purple.

JOSEPH CUTAK

JOSEPH CUTAK.—Pitchers somewhat egg-shaped, narrowed toward apex, green, including rim and lid; pitcher wings prominent, ½ inch wide, with marginal spines ¼ inch long. Leaves to extended pitchers 22–26 inches long, blade 2–3 inches broad, very dark green, new growth purplish.

DR. EDGAR ANDERSON

NELL HORNER

HENRY SHAW.—Pitchers somewhat pear-shaped, bulbose up to ridge and gradually tapering towards rim, 4½–5 inches long, basal portion up to 2½ inches in diameter, 2 inches in diameter above ridge, light green irregularly spotted with purple-red; pitcher wings marked like the pitcher, marginal hairs short; rim green, with purple stripes; lid green, with minute purple spots on the medial arched veins on the under-side, top purple-veined. Leaves 13–15 inches long from the base to the pitcher, width of blade 2¼–2½ inches.

NELL HORNER.—Pitcher egg-shaped to pear-shaped, without the prominent neck, 4 inches or more high, lower half 2 inches in diameter, pale green flushed with pink, veins conspicuously pinkish toward the neck; pitcher wings ½ inch wide, with prominent reddish marginal hairs; lid never erect, purple-spotted on the under-side and flushed with purple on the upper, with a prominent green spur; rim green and corrugated. Leaves to extended pitcher 14–16 inches long; blade 3 inches broad, irregularly denticulate on the margins; petiole 2–3 inches long.

In the southern and western Ozarks the Winged Elm *(Ulmus alata)* is a common tree in thickets and rocky places. As its name indicates, it may have thin ridges of grayish cork running along the twigs. When these wings are highly developed (as in some saplings) they lend a bizarre air to the branches. One or two branches brought into the house during the winter make effective decorations just by themselves. They might well be used as the basis of "line arrangement" by those who practice this art.

CAPSICUM PUBESCENS, A LITTLE-KNOWN PUNGENT PEPPER FROM LATIN AMERICA

CHARLES M. RICK*

To the traveller in the Andes one of the pleasant surprises is the strange array of indigenous food plants. While recently studying the cultivated and wild tomatoes of Peru and Ecuador, the writer had the opportunity of observing certain of these plants that may be unfamiliar to the visitor, yet very important to the welfare of the natives. One of these is *Capsicum pubescens* R. & P., which is known as the *rocoto* or *llata* in the Andes and as *chile manzana*, *chile cuadro caldo*, and other names in Guatemala.

This pungent pepper (hereafter referred to as the *rocoto*) is cultivated at higher elevations in the Americas from Mexico to Peru, where it is often grown simultaneously with other cultivated pepper species. Like maize, sweet-potato, *pepino*, and certain other crop plants of the Andes, it is apparently known only in cultivation. Possibly man is responsible for the absence of its wild counterpart; land in the Andean region is so valuable for agriculture that perhaps the only sites in which the wild form would grow have been occupied by man and his cultigens. Even if some of the wild type had persisted, they might have hybridized with the improved forms to such an extent that they would have lost many of their original features and become difficult to distinguish from the cultivated forms.

Yacovleff and Herrera[1], quoting evidence from the writings of colonial historians, include the *rocoto* among plants that were used by the ancient civilizations of the Andes. Peppers of some types must have been known because they are abundantly represented in the prehistoric ceramics and fabrics, but to say with certainty that any of these figures represent *rocotos* is difficult for two reasons: (1) the representations of peppers are highly stylized; and (2) even if accurately represented, they might not be distinguished from other cultivated peppers because fruits of certain shapes and colors are common to several species.

Characteristics of the fruit.—The *rocoto* varies to the greatest extent in the size, shape, and color of its fruits. Many different fruit types were seen by the writer in both markets and gardens in Peru and Ecuador. Some idea of the range of variation in form of fruits is given in figs. 1–3. They vary from ones that are three times as long as broad to others that are 1½ times as broad as long. Elongate forms in Peru have a more or less well-defined

* Fellow, John Simon Guggenheim Memorial Foundation and Visiting Investigator at the Missouri Botanical Garden, 1949; on sabbatical leave from the University of California, Davis, California.

[1] Yacovleff, E., and Herrera, F. L. El mundo vegetal de los antiguos peruanos. Rev. Mus. Nac. [Lima, Peru] 3:242–322. 1934.

Fig. 1. Fruits of 9 types of *rocoto*. Arequipa, Peru. Upper row, left to right: (1 and 2) red, 2 cells; (3) orange-red, 4 cells (note depressed stylar end); (4) yellow, 2–3 cells; (5) yellow, 2 cells. Lower row, left to right: (6) dirty yellow overlaid brown, 3 cells; (7) red, 3 cells; (8) orange, 3 cells; (9) yellow, 2 cells.—About ½ nat. size.

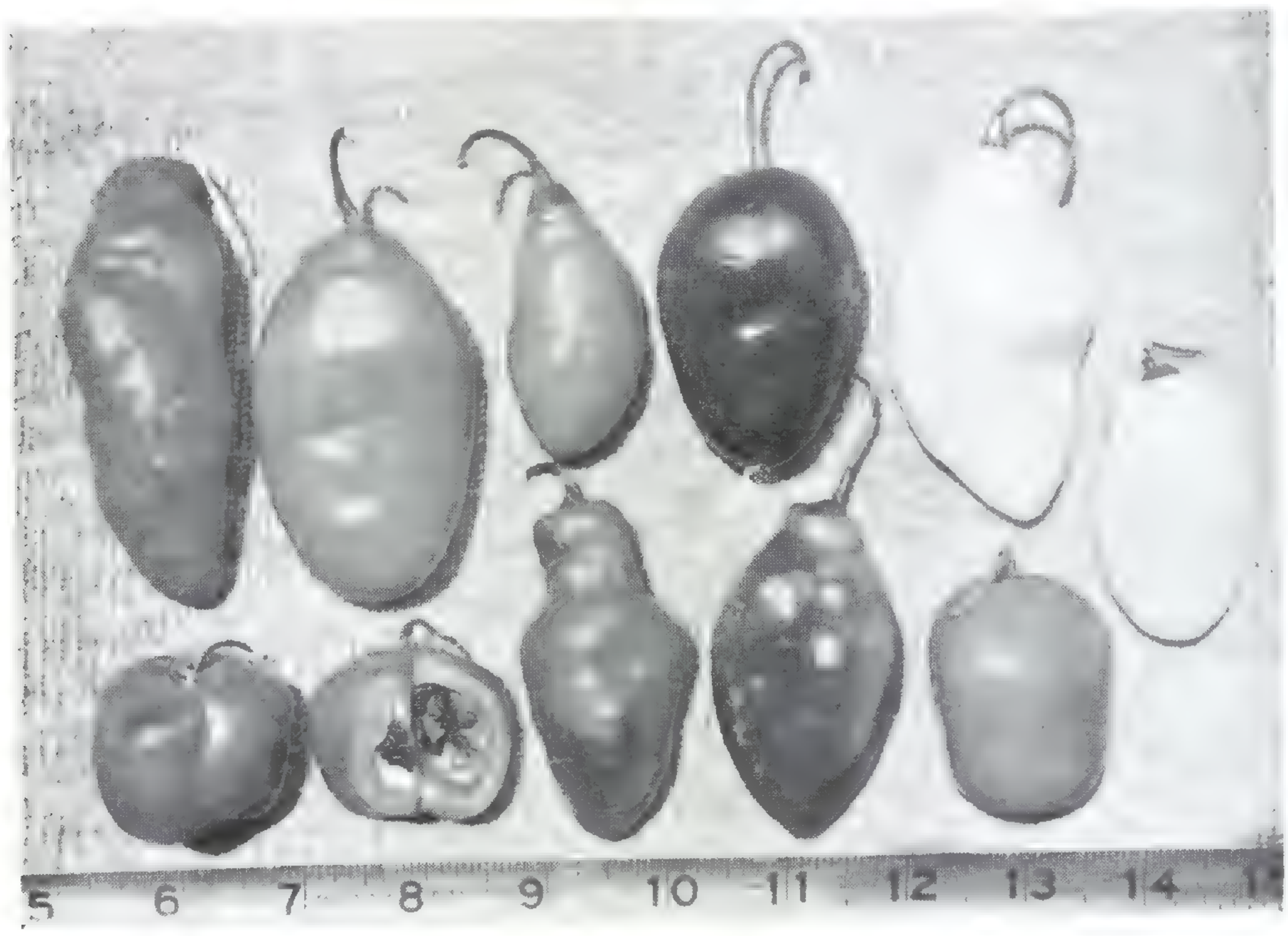


Fig. 2. Fruits of 10 types of *rocoto*. Cuzco, Peru. Upper row, left to right: (1) red, 2 cells; (2) red, 3 cells; (3) red, 2 cells; (4) chocolate-brown, 2 cells; (5 and 6) yellow, 2–3 cells. Lower row, left to right: (7 and 8) red, 3–4 cells (note seeds and thickness of flesh); (9) dirty yellow overlaid brown, 2–3 cells; (10) dirty yellow overlaid brown, 2 cells; (11) red, 3 cells.—About ½ nat. size.

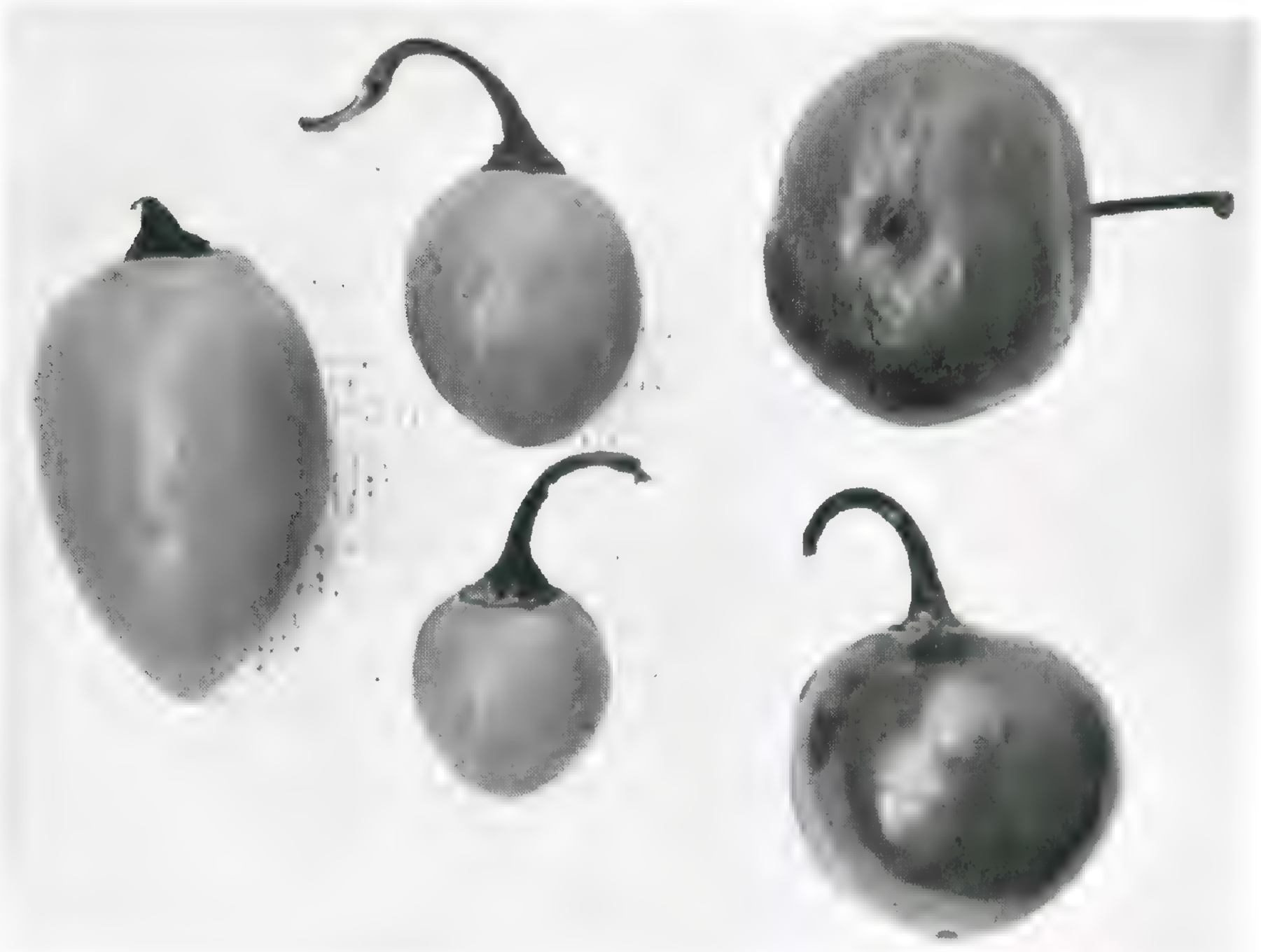


Fig. 3. Fruits of three types of *rocoto*. Ambato, Ecuador. Left to right: (1–3) golden-yellow, 2 cells; (4–5) red, 2–3 cells (note depressed stylar end). —About ¾ nat. size.

neck (figs. 1 & 2), which was not seen in any *rocotos* from Ecuador (fig. 3). The stylar end (opposite to the stem end) is always depressed in the shorter forms (fig. 1), less frequently so in the longer forms. The fruits have from two to four cells, the number tending to be greater in the broader forms and fewer in the more elongate ones. There is also variation in the roughness of the outer surface of the fruit and in the shape of the calyx. In respect to all of these characteristics, at least fourteen different fruit shapes can be recognized.

The fruits are even as variable in their colors as in their forms. The following seven distinct colors were seen: red, orange-red, orange, two intensities of yellow, chocolate-brown, and dirty yellow overlaid with brown. On two occasions a variety was mentioned that is supposed to maintain a green color at maturity, but of the fruits supposedly of this type that were given to the writer, all eventually turned to either a red or yellow during storage. Many of the color variants pass through a black phase before finally assuming their characteristic mature pigmentation. Many different, but by no means all the possible, combinations of colors and shapes were found. Although all combinations might be obtained by appropriate breeding methods, probably many of them do not exist because certain colors such as the browns and orange and certain forms such as the small spherical and greatly elongated ones are relatively uncommon.

Although these various fruit types may be distinguished by local names, the writer is not aware of a general use of varietal names in the sense that we apply names to our domestic varieties of vegetables. Plantings are characterized by great variation from plant to plant in form and color of fruits. A uniform race was seen on only one occasion. Many of the fruits shown in figs. 1–3 represent only single plants. In certain plantings it was possible to distinguish the fruits from each plant, for, although the fruits from different plants differ greatly, those from the same plant are remarkably uniform. One can also distinguish with reasonable accuracy the fruits from different plants as they are displayed in small heaps of mixed type in the markets. This great variability from plant to plant must mean that the *rocotos* of Peru and Ecuador, like so many other cultivated plants of those countries, are very heterozygous (i.e., they do not breed true).

Characteristics of the plant.—As much as the *rocoto* varies in fruit characters, it is remarkably constant in the features of its stems, leaves, flowers, and seeds. Plants that differ greatly in the form and color of their mature fruits exhibit essentially the same characteristics in other parts of the plant. The following characters are the most important for identifying this species: hairs that abundantly cover the leaves and stems (fig. 4), dark purplish, partly hooded flowers (fig. 4), pronounced folding between petals,

Fig. 4. Branch of 3-year-old *rocoto* plant showing flowers and single fruit. Arrow points to part of stem where hairiness is evident. About two-fifths natural size.

and large seeds that are either black or dark brown and have wavy edges (fig. 2). As pointed out by Heiser and Smith[2], although these characteristics may occur singly in other cultivated and wild peppers, they serve to distinguish the species when considered in combination. The *rocoto* closely resembles our familiar cultivated species in the habit of plant, the arrangement of leaves and flowers, and many other characteristics.

Heiser and Smith were unable to hybridize the *rocoto* with other cultivated peppers. Observations of the writer would also suggest that they do not interbreed, for when grown close to each other in Peruvian gardens, as they now are and doubtless have been for centuries, they maintain their character differences. No plant or fruit that in any way suggested hybridization of the two species was ever seen by the writer or mentioned to him by the many people consulted.

Distribution and cultivation.—The *rocoto* is peculiarly adapted to the 6,000–10,000 ft. altitude zone on both western and eastern slopes of the Andes. At lower altitudes in Peru the plant will survive and produce a few fruits, but scarcely any seeds. Above this belt low temperatures probably restrict growth. When tested at Davis, California, and elsewhere in the United States, it has not performed well.

The growth requirements of the *rocoto* are not well understood. The climatic conditions at Arequipa, Peru, where it is very well adapted, are remarkably constant throughout the year. The number of daylight hours per day is probably not greater than 13 nor less than 11. Winters are slightly colder than summers, and daily variations of from 55–65° to 80–90° F. are the rule. According to Heiser and Smith the *rocoto* may produce flowers only when day-lengths, like those throughout the year in the central and northern Andes, are between 11 and 13 hours. Accordingly, it could not be expected to perform as a summer vegetable in the United States, because the days are too long to permit flowering. It is more difficult to explain its failure to grow on the coast of Peru, where day-lengths cannot possibly be responsible because they are the same as those of the Sierra of the same latitude. Higher mean temperatures or the presence of diseases that do not exist at higher altitudes might account for the difference in behavior.

Fruits of the *rocoto* are durable and readily withstand shipping, and, despite the cultivation in a restricted zone, they are transported in large quantities to markets on the coast and in the higher Andes. The plant bears fruits continuously from January to July in the vicinity of Arequipa (altitude 7,400 ft.). It is said to bear throughout the year at lower elevations.

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[2] Heiser, Charles B., Jr., and Smith, P. G. Observations on another species of cultivated pepper, *Capsicum pubescens* R. & P. Proc. Amer. Soc. Hort. Sci. 52:331–335. 1948.

Fig. 5. Plant of *rocoto* (lower foreground), Hacienda of Sr. Carlos Nuñez near Arequipa, Peru, March 25, 1949.

In Peru and Ecuador the *rocoto* is grown as a long-lived perennial. Although plants will bear fruit in less than one year from the time of seeding, older plants yield more. Since the plant is as susceptible to frosts as our more familiar garden peppers, this fact would further restrict its usefulness in the United States. Plantings are usually maintained for four to five years, and one plant shown to the writer in Yungay, Peru, was said to be over fifteen years old. Such longevity is probably not unique to this species; other cultivated peppers are often grown as perennials in the tropics.

The *rocoto* plant resembles our familiar peppers in general appearance in the first year of cultivation, but older specimens may grow as high as five feet. Occasionally plants were seen supported by poles and by sticks woven

among the branches (fig. 5). Usually *rocoto* is grown as an incidental plant along the borders of the garden, where it will not interfere with the cultivation of annual or biennial crops. Here it will often be seen growing in the partial shade of fruit trees, which does not seem to affect its growth adversely. It thrives equally well in full sunlight.

Uses.—In the mid-altitudes of the Peruvian Andes, the *rocoto* is highly esteemed and is used to the same extent as other peppers. For hot peppers their flesh is unusually thick—⅛ to 3/16 inch (fig. 2). They are nearly always harvested when mature. Even if picked before the final color has developed, they are allowed to reach full size.

In the opinion of the writer, they are intermediate between the least and the most pungent peppers. As in hot varieties of *Capsicum frutescens*, the pungency is limited to the seeds, placenta, and membrane lining the inner wall of the fruit. When the placenta and seeds are removed in preparation for stuffing the fruit, the pungency is intentionally or unintentionally reduced. Aside from the pungency, the fruits have their own distinctive, though indescribable, aroma.

The fruits are used either fresh or cooked. As fresh vegetables, the whole fruits are often served separately as a garnish, leaving to the discretion of the individual the amount he cares to add to his soup or stew. As a cooked vegetable the *rocoto* is usually stuffed with meat preparations in a manner similar to our use of the large sweet peppers.

The *rocoto* is of doubtful value in the United States, either for cultivation in its present state or as a source of desired characteristics for breeding purposes. In most areas the growing season is too short or the day-length unfavorable for flowering, and in areas where the season is long enough the cross-incompatibility with other cultivated peppers precludes the transfer to them of any desired qualities that it might possess.

NOTES

Mr. Paul H. Allen, Tropical Collector to the Garden, spent a week at the Garden during January, going over his collections of plants.

Recent visitors to the Garden include: Dr. Ralph O. Erickson, Professor of Genetics, University of Pennsylvania, Philadelphia; Dr. William L. Brown, Geneticist, Pioneer Hi-Bred Corn Co., Johnston, Iowa; Mr. Robert A. Evers, of the Illinois Natural History Survey, Urbana; Dr. Carl O. Sauer, Professor of Geography, University of California, Berkeley; Dr. Bruno Reitmann, Medical Mycologist, of Bahia, Brazil; Mr. J. I. Rodale, author of books on soils and organic gardening; Mr. Edward Hummel, of Hummel's Exotic Gardens, Pasadena, Calif.; Mr. Robert A. Vines, Director Museum of Natural History, Houston, Texas.

THE MISSOURI BOTANICAL GARDEN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 40,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until 7:00 p. m.; Sundays, 10:00 a. m. until 7:00 p. m. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah bus line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

MISSOURI BOTANICAL GARDEN BULLETIN

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Curtain used at the graduating exercises of the John Scullin School, showing structures and markers connected with the life of Henry Shaw.

Missouri Botanical Garden Bulletin

Vol. XXXVIII MARCH, 1950 No. 3

AN HISTORICAL SKETCH CELEBRATING THE SESQUICENTENNIAL OF THE BIRTH OF HENRY SHAW

In 1941 Miss Stella Michel, teacher of the eighth grade at the John Scullin School in St. Louis, favored the BULLETIN with the papers given at her June 1941 graduation program on "Historic Trees of Missouri." The painstaking research necessary to produce this program was appreciated by BULLETIN readers. The year 1950, being the sesquicentennial of the birth of Henry Shaw, Miss Michel has taken this noted St. Louisan as the subject of the January graduating exercises. The series of historical sketches was compiled with such thoroughness and is of so great local interest that the BULLETIN is glad to devote a portion of this issue to the papers as they were read by the pupils at their graduating ceremony on January 25.

ADDRESS OF WELCOME

In behalf of my schoolmates of this class of January, 1950, I bid you a hearty welcome to our exercises this morning. We are glad to see so many of our friends and loved ones present, and to know that you are interested in our welfare and progress. We trust that you will enjoy our program, the theme of which is "Henry Shaw."

On the curtain before you [see frontispiece] are pictured certain buildings, monuments, markers, and columns intimately connected with the life and work of Mr. Shaw: the dates, 1800 and 1950, remind us that July 24th of this year will mark the sesquicentennial of his birth; one of the courthouse columns at the north gate of Tower Grove Park; the riverfront marker at the site of Henry Shaw's early hardware store; the statue of Alexander von Humboldt at the eastern end of the park's mall—a work of art honoring the intellect, courage, and industry of this philosopher and scientific explorer; a tablet establishing ownership to one of Mr. Shaw's numerous realty holdings; one of the famous lions at the east entrance; the stone work removed from the ruins of the old Lindell Hotel fire to be used in adorning the

north bank of Tower Grove's pond; reproductions of three of the bronze insets on the Humboldt monument's pedestal; and Mr. Shaw's former city residence.

On the frieze to your right is a quotation very aptly describing Henry Shaw's gift to the public of the Shakespeare, Humboldt, and Columbus monuments. On these friezes and the bulletin board to your right are photographs and photostats obtained through the courtesy of the Library of Congress, the Missouri Historical Society, the Superintendent of Tower Grove Park, and our own Mr. Sprunk. There is an old United Railways car-display sign advertising the night-illumination of the lily-ponds.

We trust that as we now go forth into fields of higher education we may acquire a good measure of that educational equipment which enabled Henry Shaw to educate himself during a long and busy life, and that we may strive to emulate his qualities of thrift, prudence, and integrity.—*Marilyn White.*

HENRY SHAW

Henry Shaw, founder of the Missouri Botanical Garden, was born at Sheffield, England, July 24, 1800, the eldest of the four children of Sarah Hoole and Joseph Shaw, both natives of Leicester. His father was a manufacturer of grates and fire-irons. Henry's primary education was obtained at Thorne, a village not far from his native town. Between the ages of 10 and 16, he attended Mill Hill School near London where he acquired a knowledge of the classics, French, Latin, Greek, and received excellent training in mathematics.

Emigrating to Canada with his father in 1818, he was sent to New Orleans to learn the cotton business, but he remained less than a year. On May 3, 1819, he arrived at the small and remote French Trading Post called St. Louis, and soon set up a small hardware and cutlery business. Social life had little attraction for him, but he read widely and applied himself diligently to his work. By the time Mr. Shaw was 40, he had accumulated what he regarded as a fortune and retired.

Most of the next ten years he spent in travel, visiting England, Europe, Constantinople and Egypt, improving his knowledge of languages, and becoming, though his tastes remained sober, a thoroughly cosmopolitan gentleman. It was on his last trip to London early in 1851 that the idea of having a Botanic Garden of his own dawned upon him.

He had a great interest in plants, and with advice from outstanding botanists, both here and abroad, he established a garden in St. Louis that was in reality a scientific institution for the study of plants. After 1851, he scarcely left the city, but devoted his time to the development of his garden and to the planning and planting of Tower Grove Park. He built up the

nucleus of one of the best botanical libraries, as well as one of the largest herbariums, in the United States, and provided in his will for the maintenance of a scientific staff which was to conduct investigations in botany proper, in vegetable physiology, the diseases of plants, and the study of the forms of vegetable life. He also endowed what has come to be known as the Henry Shaw School of Botany of Washington University.

Mr. Shaw never married. He died August 25, 1889, and was laid to rest in the Garden in a place he had chosen.

During his lifetime, the institution he founded was the only one of its kind in the United States, and, since his death, Shaw's Garden has continued to be one of the important botanical gardens of the world, while Tower Grove Park remains one of the most charming pleasure grounds to be found in any city of this country or of Europe.—*Betty Walls.*

HENRY SHAW'S HARDWARE STORE

On the west side of First Street just north of Market stands a shield-shaped metal marker erected by the Young Men's Division of the St. Louis Chamber of Commerce which designates the site of the early hardware store of Henry Shaw. On the second floor of the building here, shortly after May 1819, he rented a room in which he cooked, slept, and ate, and from which he sold the small stock of cutlery he had purchased in Sheffield, England, with money advanced by his uncle.

From this humble beginning, Mr. Shaw became one of the busiest merchants, importers, and outfitters in the Middle West. In addition to such items of frontier hardware as scalping knives, iron kettles, beaver traps, and ax heads, he dealt in textiles and china. He traded with the Indians for buffalo tongues which were regarded as quite a delicacy, raw hides, bears' tallow, and other wilderness products the red man could supply. His business became a factor in the early western trade of the United States, and was the foundation of his extensive estate represented today in Tower Grove Park and the world-famous Missouri Botanical Garden.

In a St. Louis directory of this period, the following are listed as some of his First Street neighbors: Ricketson & Holt, dry goods merchants; J. C. Essex, stationer and bookbinder; L. A. Benoist & Co., Exchange Banking House; Jaccard & Recordon, jewelers and watch makers; Tontine Restaurant; Widow Chouteau; General William Clark; Edgar & Forsythe, saddlery-ware merchants; Charless & Blow, druggists.

After retiring from the hardware business, Henry Shaw boarded at the Planters' House Hotel in which he owned shares of stock, and by 1854, was living in his City House on the southwest corner of Seventh and Locust Streets.—*Eleanor McAdams.*

HENRY SHAW'S CITY HOME

When Henry Shaw returned from Europe in December, 1851, his town house was under construction on the southwest corner of what is now Seventh and Locust. Here, where the iron balconies on the north side looked out from his bedroom onto Locust Street, he spent the greater part of each year for the rest of his life.

His will, drawn up in 1885, contained the provision that his City residence, being built of good and durable materials but unsuitable to its locality, should be carefully taken down and rebuilt on Tower Grove Avenue on a site convenient to the Botanical Garden. He bequeathed the sum of $10,000 to the Board of Trustees for this removal and rebuilding.

In 1890, shortly after Mr. Shaw's death, this rather distinguished-looking home was dismantled and put up brick by brick at 2315 Tower Grove for office use. The southern wing which was added later doubles the size of the original house and contains the Library, the Herbarium, and space for students. The entire structure is now known as the Administration Building.

The ground on which the Shaw Town House once stood is now occupied by the Locust Building Corporation whose address is 315 North Seventh. It fronts $90\frac{2}{3}$ feet on Seventh Street and extends $127\frac{7}{12}$ feet along Locust. To most of us it is known as Katz' Drug Store.

A marker, consisting of a painting depicting the site as it appeared when Henry Shaw occupied it and a brief historic text enclosed in a bronze weather-proof frame, was erected at the entrance to this building by the Young Men's Division of the St. Louis Chamber of Commerce. However, it has not been maintained by the occupants.—*Robert Richardson.*

MR. SHAW'S GARDEN

The institution popularly called "Shaw's Garden" was founded by Henry Shaw in 1858 and, while virtually a private country estate, was opened to visitors on certain days in the year 1860. From that time until his death in 1889, Mr. Shaw maintained close personal supervision. The name, "Missouri Botanical Garden," was selected by him and he definitely indicated that he wished *that* to be its official designation.

According to a provision of Mr. Shaw's will, the Garden passed into the hands of a self-perpetuating Board of Trustees. The Chancellor of Washington University, the Mayor of the City of St. Louis, the President of the St. Louis Academy of Science, the Bishop of the Episcopal Church of the Diocese of Missouri, and the President of the St. Louis Board of Education were to be *ex-officio* members.

The City Garden which comprises 75 acres where about 12,000 species of plants are grown both out of doors and under glass, is hidden away from the outside world by sturdy old-fashioned limestone walls, so high that the passer-by catches only tantalizing glimpses of tree-tops or of vines which spill down over the gray-white rocks. Within are Mr. Shaw's "Old Residence," "Tower Grove," which was built as a country house in 1849; a Rose Garden; the Linnean House and Garden; a Palm House; Tropical Lily Pools; a Floral Display House; an Italian Garden; a Plant Curiosities House; an Iris Garden; a Desert House; an Experimental Greenhouse; a Museum; and a shady grove surrounding Mr. Shaw's Mausoleum.

At Gray Summit, about 40 miles west of the Garden on Highway 66, a new Arboretum has been developed because of the smoke problem in St. Louis. Here, on a 1,625-acre tract in which a colorful example of typical Ozark landscape is being preserved, more than 500 species of wild flowers, shrubs, and trees are cultivated.

Up until 1939, when diminished income forced its abandonment, Shaw's Garden maintained an orchid-growing station at Balboa, Panama Canal Zone. Today its collection of 25,000 orchid plants includes varieties seen nowhere else, and its orchid exhibit is the largest and most complete in the world.

The Missouri Botanical Garden receives no support from city or state but is maintained almost exclusively from the income of the estate left by its founder with the stipulation that the grounds always remain free to the public.—*Helen McChesney.*

TOWER GROVE PARK

Exactly when the idea of creating what is now Tower Grove Park first came to Henry Shaw is unknown, but it was doubtless suggested by what he had seen in Europe. It took active shape when his garden was firmly established and seemed to need some such supplementary accompaniment. The first steps were taken in 1866, but the enterprise did not assume definite form until the following year.

Between Grand Avenue and the Old Spanish Road that for many years had been known as the King's Highway, and adjoining the Garden on the south, Mr. Shaw owned a parcel of ground rolling in surface and admirably adapted for ornamental improvement. He determined to submit to the Mayor a proposition to donate this tract comprising nearly 300 acres to the City of St. Louis for use as a "driving park," provided public funds were furnished for its maintenance. This was a donation equal in value to about $300,000.

Since the city limits at this time had been established along a line 660 feet west of Grand Avenue, the territory offered would extend about a mile

and a half into the county. It was, therefore, necessary that the acceptance of the land and the creation and improvement of the park should be authorized by the state legislature. A special act for this purpose which was passed during the winter session was approved March 9, 1867. On October 20, 1868, the Mayor and Mr. Shaw jointly signed the deed of gift, and, from that date, Tower Grove Park may be said to have had a legal existence.

The exclusive control and management were vested in a Board of Commissioners to consist of between five and seven persons, to be selected by Mr. Shaw, and of this Board he was made a member during his lifetime.

The shape of Tower Grove Park is that of an oblong, with the length many times greater than the width. Since the land was originally a rolling prairie of rich loamy soil, without springs, ponds, or other distinctive features of a picturesque character, there was nothing unique about the tract except prairie grass and clover. The surface originally embraced no woodland; therefore, all the trees and shrubs had to be planted. In this work, the utmost care was taken: each tree was set in a dug space 5 feet wide and 3 feet deep, staked and tied, and every possible measure adopted to insure health and quick growth. In all, nearly 20,000 trees were planted in lines, groups, and singly.

Within three years from the commencement of the work of improvement, Tower Grove Park was ready for public use—a remarkably short period when it is remembered that at the beginning the land was almost bare and treeless, without lawn, attention to soil, or proper drainage.—*Carolyn Mohrman.*

THE EAST GATE

The principal entrance to Tower Grove Park is situated at the east end and fronts on Grand Avenue. Its construction in 1870-71 was a difficult and expensive piece of work as a considerable amount of filling-in had to be done in order to effect a satisfactory grade. The stone-work of the piers and walls was executed in a most careful and artistic manner, with a view to permanence and beauty. The design was controlled by a desire to combine grace and freedom in the outline; to render the structure impressive and appropriate to the park scenes beyond it, without employing any other architectural features than graceful columns set at intervals, adorned by artistic "bronzes," connected by an airy lace-work in iron, flowing in curving lines.

Two of the 30-foot gray limestone pillars resting upon bases of red granite blocks are surmounted by metallic figures of winged griffins and two bear couchant lions. These are works of art of decided merit which were designed and executed in Berlin. They are made of zinc which is much less expensive than bronze, but when kept painted is almost as indestructible.

The lions, one of which is sleeping and the other watchful, are particularly worthy of notice since they are replicas of Antonio Canova's well-known recumbent figures which are set on either side of the monument of Pope Clement XIII in the Church of St. Peter at Rome. They appear as guardians at the doorway of the elaborate tomb and lie with their heads on their paws. The facial expression of the sleeping lion very strongly suggests weeping; hence, this figure is known as the celebrated "Weeping Lion" of Canova, the Italian sculptor.

The secretary of the Caproni Galleries in Boston which for over a century have been leaders in the reproduction of sculpture from the world's masterpieces informs us that plaster copies of these "Two Lions" by Canova are still requested by art schools and colleges. Through the Photoduplication Service of the Library of Congress, we were able to obtain copies of the Clement XIII Monument and of a detail showing the so-called "Weeping Lion."—*Audrey Faerber.*

THE NORTH GATE

In its general design, the North Gate at Tower Grove and Magnolia is somewhat similar to the main entrance on Grand Avenue, but the columns are not so massive and there is less metallic ornamentation. It is a combination of old architectural elements with newer materials and embraces a gateway for vehicles and two for pedestrians.

On either side of the central gate and at the termination of the curving wall and railing on the street line, rising from a cut limestone pedestal, is a round shaft, colored like red marble or granite, supporting a square stone cap of two steps on which is a ball of limestone, light gray in color, elevated nearly 30 feet. These smooth round pillars formerly assisted in supporting the balcony of the Old Courthouse. In 1874, when some structural changes were made in the rotunda, four of the interior columns were removed. In accordance with a request of Henry Shaw, they were transferred to Tower Grove Park to be utilized in the ornamentation of this North Gateway, and there they still stand.—*Olan Heape.*

THE HUMBOLDT MONUMENT (Part I)

Although Henry Shaw is rightly regarded as one of the greatest benefactors of the city of his adoption, this idea is based primarily, if not entirely, upon his founding of the Missouri Botanical Garden and his gift to St. Louis of Tower Grove Park. Still another aspect of his generosity and desire to give pleasure to his fellow townsmen, which is not so generally recognized, was his effort to provide objects of art, in the form of statues and busts, which were worthy of the men they commemorated.

As early as 1878, he presented to the city two bronze statues which at that time were among the most noteworthy pieces of this character in the United States. These gifts were followed by others, until, at the time of his death, eleven years later, he had made available to the public another bronze statue, three marble statues, and nine marble busts, all executed in the best artistic manner of the period.

The statue of Alexander von Humboldt which is pictured on our curtain stands in Tower Grove Park 857 feet east of and facing the Shakespeare monument. It is the work of Ferdinand Miller of Munich, Germany, and cost $5,000 delivered in St. Louis, not including the pedestal or the setting up. It rests upon a foundation of Missouri red granite designed by George I. Barnett, a St. Louis architect.

The base rises in three steps to a height of about three feet, while the pedestal of polished granite is 8 feet high. Into three of its sides bronze relief medallions are set.—*Vasso Katinas.*

(Part II)

On the south side is a landscape view of Mount Chimborazo, a volcano in Ecuador, inseparably associated with the life and works of Humboldt because he described it and was the first to gain its towering snow-capped summit.

On the east side there is an excellent likeness of Mr. Shaw, and underneath it the inscription: "In honor of the most accomplished traveler of this or any other age. Erected by Henry Shaw, 1878." On the north side, the relief depicts a view in the Valley of the Amazon which is an eloquent suggestion of travel in tropical lands. On the front is the name, Alexander von Humboldt, cut in large plain letters.

The figure stands about 11 feet high, and represents von Humboldt in the prime of early manhood, dressed in the traveling costume of the period. He leans against the trunk of a tree over which his cloak is thrown. The hands are loosely clasped in front, the right one holding a partially opened map. The head is uncovered and slightly bowed.

The niece of Humboldt, after seeing this statue of her uncle before it was shipped from Munich, wrote Mr. Shaw thanking him for the high honor conferred upon her family, and said Europe had done nothing comparable to it for the *great naturalist.*

At the unveiling ceremony on November 24, 1878, it was said of von Humboldt: "The whole world was his home, and he knew no nationality but mankind. He was a friend of free institutions. Nature was his God, Science his religion."—*Robert Schneider.*

Statue of Alexander von Humboldt presented by Henry Shaw to Tower Grove Park

"H. S."

That Henry Shaw knew the value of money is evidenced by the fact that he retired from active business at the age of 39, content with what now looks like the quite moderate fortune of $250,000. He felt he had enough and intended to enjoy it. That his estate fifty years later embraced two million dollars worth of real estate is proof that he was an astute investor and a business man of high order.

Exclusive of the Missouri Botanical Garden, Tower Grove Park, Tyler Place, and the private street known as Shaw Place, much of his property was in the downtown business area. The various lots faced on Main Street, Second, Fourth, Sixth, Seventh, Poplar, Plum, Market, Washington, St. Charles, Olive, and Lafayette. Some were improved with store buildings or warehouses, others with tenements or dwellings.

How many of these structures were erected by Mr. Shaw himself is unknown, but for at least two of them the proof of ownership is unmistakable. Just a few inches below the second-story window-sill at the northeast corner of Seventh and St. Charles a stone tablet about twenty inches long and five inches high is set in the brick wall. It bears the initials, "H. S.," and the date "1880." This property, recently remodeled, is still owned by the Board of Trustees of the Garden and is under 20-year lease to the Richman Brothers Clothing Company.

The building at 508–510 Washington Avenue which houses part of the Woolworth 5 and 10¢ Store has another such marker set in between the second-floor windows. This is a stone panel about 8 feet high and 2½ feet wide. Cut in the tablet at about the center are the date, "1883," and Mr. Shaw's initials.

That Henry Shaw possessed unusual natural business ability and proceeded as systematically with his commercial affairs as with the development of his Garden and Park, no one can deny.—*Marvin McAdams.*

THE RUIN

Covering the block now occupied by Stix, Baer and Fuller, also known as the Grand Leader, the seven-story Lindell Hotel which was opened to the public on Oct. 19, 1863, was rated the finest west of New York. It housed the Board of Trade and the Y.M.C.A. Here on Sept. 8, 1866, President Andrew Johnson, General Ulysses S. Grant, Admiral David Farragut, and General Winfield S. Hancock were entertained.

During the night of March 30, 1867, fire was discovered on an upper floor of the 530-room hostelry. Prompt sounding of the alarm enabled every occupant to escape, but efforts of firemen to stop the conflagration were fruitless. By morning the $2,000,000 structure was nothing but a shell.

From the ruins of this first Lindell Hotel, a number of stone blocks were selected to be used in forming a rockery on the north bank and a fountain base in the pond at Tower Grove Park. The effects of water under high pressure and fire had made these pieces of Joliet limestone look as though they had been cut centuries before.

In 1873, these large stones, including some broken columns, were laid together in an artistic arrangement to resemble a ruined facade having an irregular but graceful outline. This ruin is the feature that more than anything else stamps the name "Victorian" upon Tower Grove. All the authorities on landscape design during the mid-nineteenth century thought that one of the most delightful features for a public park on a private estate was a bit of "architectural antiquity" preferably situated where a reflection of it could be seen in a smooth sheet of water. Although this pond is not large enough to permit boating, it affords an ideal spot for the youngsters of the area who have toy boats to sail.—*Joan Grassmuck.*

CHRONOLOGICAL HISTORY OF THE EARLY DAYS OF SHAW'S GARDEN

1800—Henry Shaw born on July 24.

1820—Henry Shaw visited what is now "Shaw's Garden" for the first time. It was called "La Prairie de la Barrière à Denoyer" from Louis Denoyer, who kept the gate of the fence by which the commons of the old village of St. Louis was surrounded. No trees growing on the land then except "three venerable cottonwoods."

1839—Shaw retired—see "Life of Shaw" BULLETIN.

1840—Land for "Shaw's Garden" was acquired by purchase from Thomas Jefferson Payne. Payne had laid it out as a race-track, the center of which was in a grove of trees. Shaw built his house near this grove, and, because it had a tower, he called his property "Tower Grove." Price of property not given.

1849—Mansion at Tower Grove completed.

1851—Idea of Garden born while Shaw visited estate at Chatsworth, England.

1855—Plan of Missouri Botanical Garden (Henry Shaw, himself, wished it called that) had been determined on, drains constructed, and wall commenced.

1856–1857—Engelmann purchased books and Bernhardi herbarium in Europe. His influence and the encouragement of Sir William Hooker, then Director of Royal Botanic Gardens, at Kew, England, decided Shaw to build a library and museum building.

1857—Shaw writes in his diary that "the Garden has been trenched over 2 feet deep (cost $1,000.00) and in fine order for planting anything—2 large tanks, 10,000 gals.—2 wells . . . Drains and tanks cost $2,000.00. Am now building the walls of stone and brick . . . two sides cost $6,000.00 . . . I intend to have everything substantial and elegant . . . I shall commence the ornamental planting next spring."

1858—Stone wall on the west side and brick wall coped with stone on north sides finished at a cost of $8,000.00. Plant houses and rosarium, also entrance lodge, commenced. Old gateway completed in 1858 from a design of George I. Barnett's.

1860—Museum and library building completed at a cost of $25,000. First curator (August Fendler) of Garden and Museum appointed. Arboretum and Fruticetum started, "comprising all the trees that grow in this climate and locality." Trees mostly planted in rows, and many measured each year to get the rate of growth. Unfortunately, many of them were destroyed by the tornado of 1896.

1868–69—The plants having outgrown the original greenhouses, a palm house with additional wings for "moist and temperate house" built. "The learned Agassiz was here," writes Shaw, "and was much pleased with our Garden . . . The Garden was visited by increased numbers the past summer. I think not less than 40 to 50 thousand. I do wish we had something more interesting and instructive for the inspection of such multitudes."

1870's—Orchids began to demand attention, the Garden collection having been started by a gift from Mrs. Henry T. Blow of the orchids collected by her in Brazil.

1882—Linnean House (so called from the bust of Linnaeus over the doorway) completed, the only greenhouse built by Shaw still extant.

1885—Engelmann died, and Shaw, wishing to commemorate his memory, consulted Prof. Asa Gray about founding the Henry Shaw School of Botany, and establishing the Engelmann professorship of botany at Washington University. Engelmann's valuable herbarium and library were given to the Garden. Dr. William Trelease appointed first Engelmann Professor in the Shaw School of Botany.

1889—Henry Shaw died on August 25. By his will all his property, except some personal bequests, was left to a board of trustees to administer the Missouri Botanical Garden.

1890—Dr. Trelease made first Director of the Garden. School for Gardening established at the Missouri Botanical Garden.

N.C.H.

PLANT NAMES FOUND IN MISSOURI TOWNS[1]

JULIAN A. STEYERMARK

The origin of some names of Missouri towns is still obscure and a matter for future investigation, but most of them have been traced now to their sources. Apparently, the more primitive the people the closer is their relationship to the animal and plant life surrounding them. According to Eaton (Mo. Hist. Rev., vol. 10, p. 197):

> "The aborigines always used descriptive names for topographic features . . . . every place name had a significant meaning. They were not arbitrary names. It remained for the later, more cultivated and mixed races to give arbitrary names, or to transplant them from some other tongues or some other land. The original tribe of Indians living in Missouri has a name for all prominent topographic features of the country.
>
> "The history of Missouri may be very well traced in its place names. First come the Indian names, usually of some stream or topographic feature, then the French, who were the first explorers, trappers and traders or 'voyageurs' as they were called, afterward, a few Spanish, followed by the American, mixed with the foreign element of Irish and German.
>
> "Of the one hundred and fourteen counties in the State of Missouri ninety-nine have personal, two have state names, four Indian names, while the remaining nine are derived from geographical features."

In this connection it is interesting to note the number of places which have commemorated either the common or scientific name of a plant or something associated with a plant. The oak and cedar were called upon most frequently, and pine, apple, walnut, rose, maple, linden, elm, osage orange, sycamore, holly, wheat, and ash were popular in the order given.

The following localities, although bearing names of plants or names seemingly related to botany, were actually not derived from botanical sources: Yarrow, in Adair County, was named for a river in Scotland; Mayflower, in Barry County, commemorated the vessel that brought over the Pilgrim Fathers; Spruce, in Bates County, named for Spruce Township; Ashland, in Boone County, for the home of Henry Clay in Kentucky; Linneus, in Linn County, was not given in honor of the great botanist, but for Senator Lewis F. Linn, for whom the county was also named, this gentleman apparently preferring that name to Linnville, the name first suggested; and Houstonia (botanical name for Bluets or Innocence), in Pettis County, was named for Gen. Thomas F. Houston, who lived in the vicinity.

The following list, arranged alphabetically by counties, includes those names associated with plants or plant life.

---

[1]The writer is greatly indebted for aid in preparing this paper to various sources, especially to Mr. Floyd C. Shoemaker, Secretary of the State Historical Society of Missouri; Mrs. J. A. Merva, Acting Secretary of the Poplar Bluff Chamber of Commerce; Mr. Louis W. Reps, Springfield Chamber of Commerce; and Mrs. Martha Dykstra, Kirksville Chamber of Commerce; and to the following published works: Eaton, David W. How Missouri counties, towns and streams were named. Mo. Hist. Rev. vol. 10, pp. 197–213, 263–287. 1915–16; vol. 11, pp. 164–200, 330–347. 1916–17; vol. 13:57–74. 1918–19; Ramsay, Read, and Leach. Introduction to a survey of Missouri place-names. Univ. Mo. Studies, vol. 9, pp. 1–124 (especially pp. 36–37 and 103). 1934.

County	Place Name	Origin of Name
Atchison	Linden	For Linn (or Linden) trees originally growing there.
	Tarkio	Named for the river on which it is situated. Tarkio is an Indian word meaning "walnut" or "a stream where walnuts grow."
Barry	Wheaton	
Bates	Mulberry	
Benton	Poplar	
Bollinger	Greenbrier	Named for the well-known vine (Smilax).
Buchanan	Rushville	Named for the dense growth of rushes near by (probably Scirpus).
	Willow Brook	Named for a willow-bordered stream near by.
Butler	Poplar Bluff	Site formerly covered with immense yellow poplar or tulip trees[2].
	Ash Hill	The origin of this . . . group of very recent place-names has been solved for us by the discovery of their creator, Mr. William N. Barron[3], of Poplar Bluff, who writes: "The tree names were all adopted between 1905 and 1915. The reason botanical names were selected was because, after planning townsites and establishing villages, we didn't want the government to insist on changing the names selected on account of duplication." Of these names, Fagus, Nyssa, Platanus, and Quercus may still be found on maps.
	Celtis	*Celtis*, he states, is the botanical name for hackberry, which belongs to the elm family. It is a common tree in Southeast Missouri, and the timber is used indiscriminately with elm.
	Fagus	*Fagus* (beech) is found generally in groups of three or four, sometimes singly. Mr. Barron does not know whether there were any beech trees in the immediate vicinity of the town of Fagus, although it does occur in this section.

[2] "The first act of the County Court in 1829 was to appoint commissioners to select a county seat for Butler County, and they, with the consent of the court, selected what is now Poplar Bluff as the capitol of Butler County. It was then a howling wilderness covered with a heavy growth of immense poplar or tulip trees, many of which were six feet in diameter, hence the name Poplar Bluff was selected for the community which was nearly in the center of the county."—(Deems' History of Butler County, quoted in letter of November 29, 1948, from Mrs. J. A. Merva, Poplar Bluff Chamber of Commerce.)

[3] Ramsay, Reed and Leech (Univ. Mo. Studies, vol. 9, pp. 36–38) stated: "Mr. Barron . . . was secretary and attorney for the Butler County Railroad from 1907 to 1925, and was the vice-president and general manager from 1908 to 1925 . . . During his administration, Mr. Barron has purchased and had charge of 175,000 acres of land through which the railroad was built, and which supplied the mill that converted the gums and elms into barrel staves and heading. Mr. Barron is also a member of the board of supervisors of the Inter-River Drainage District, which reclaimed the land from overflow. He is besides a large stock-holder in and an attorney for the Liberty National Life Insurance Company. So he has every right to supply Butler County with as many appropriate place-names as he pleases."

County	Place Name	Origin of Name
Butler	Hicoria	*Hicoria*[4] is the botanical name for the hickories, which are abundant in the section. Shell Bark Hickory is *Hicoria ovata* and the big Shell Bark is *Hicoria laciniosa.*
	Ilex	*Ilex* is holly, but holly does not occur in bottomlands of this section.
	Nyssa	There are two *Nyssas*—*sylvatica* and *aquatica.* The former is Black Gum, the latter Tupelo.
	Quercus	*Quercus* is the botanical name for the oaks. There are 12 or 13 different species, but all are *Quercus.*
	Ulmus	*Ulmus* (Elm) is very common, and there are several species.
	Platanus	Mr. Barron adds: "Hicoria, Ulmus, Nyssa, and Quercus were selected by Mr. Charles Langlotz and myself . . . Another name of a little sawmill settlement and switch on the railroad, located about two miles north of Fagus, of course, in Missouri, is called Platanus, which is the book name for sycamore."
Callaway	Cedar City	Named for the cedar trees which were abundant on the bank and bluffs.
	Shamrock	Mr. Eaton attributes the name to the national emblem of the Irish, while, according to Mr. James P. Covington (quoted by Eaton), the town was named for a big rock near the place where the first postoffice was located.
Camden	Linn Creek	Named for the creek on which it was situated. The creek was named for the many Linn (Linden) trees that originally grew on its banks.
Cape Girardeau	Appleton	
	Daisy	
	Oak Ridge	
Carroll	Sugartree	
Cass	Lonetree	
Cedar	Arnica	The county was named for its principal stream. The stream was named for the cedar trees which are plentiful on its bluffs.
	Cedar Springs	
Christian	Linden	
Clay	Maple Park	
	Linden	Named for the Linn trees originally growing there.
Cooper	Cotton	
	Lone Elm	
Crawford	Cherry Valley	
	Oakhill	
Dade	Cedarville	

[4] Actually, *Carya* is the accepted name for hickory.—J.A.S.

County	Place Name	Origin of Name
Dallas	Cloverdale	
	Olive	
	Pumpkin Center	
	Red Top	
Douglas	Dogwood	
Dunklin	Cottonplant	Named because cotton is a staple product and cotton gins are located here.
	Hollywood	Named for the holly tree.
	Rushcreek	Named for rush-covered banks of creek on which it is located (probably Equisetum).
	Whiteoak	Named for the oak species, *Quercus alba*.
Franklin	Cedar Fork	
	Clover Bottom	
Gasconade	Oak Hill	
	Rosebud	
Gentry	Alanthus Grove	Although I have not been able to verify it, it would appear that the name was based on the Tree-of-heaven *(Ailanthus altissima)*.
Greene	Ash Grove	Named from a grove of ash timber lying near by.
	Bois d'Arc	"Named from the Osage Orange, much used at one time as a hedge. In 1844, Mr. Goodwin put out a long hedge on his place and as he had just been appointed postmaster, it suggested the name. When the post-office was moved to its present site, the name was retained." (Eaton, Mo. Hist., Rev., vol. 9).
	Palmetto	Mr. Louis W. Reps, of the Springfield Chamber of Commerce, in a letter of November 27, 1948, writes: "From an official of the Frisco Railroad, we learned that, at the time when they were selecting a name for this stop on the railroad, a man from Florida suggested the name of Palmetto [Sabal] honoring the trees of Florida. The decision was left to Mr. Will Tribolet, a merchant who made a trip to Florida, and after seeing the Palmetto Trees, they decided on that name."
	Walnut Grove	
Henry	Piper	
	Roseland	
Hickory	Wheatland	Named for the productive wheat fields surrounding the town.
Howell	Pomona	Named for the goddess of fruits, being situated in a fruit country.
	Willow Springs	Named because the spring was originally surrounded by this kind of tree.
Iron	Pippin	From the apple of that name.
	Viburnum	Named by a physician for the medicinal plant Viburnum (Black Haw).[5]

[5] A letter received November 17, 1948, from Mr. Clifford Parmer, Secretary of the Arcadia Valley Chamber of Commerce, gives the following information: "About 1900, the Sligo

County	Place Name	Origin of Name
Jackson	Lone Jack	From the fact that a lone Black Jack Oak stood on the original site.
	Oak Grove	Laid out in 1878 in an oak grove.
Jasper	Maple Grove	
Jefferson	Cedar Hill	
Johnson	Elm	
	Magnolia	
	Postoak	Named for the Postoak *(Quercus stellata)*.
	Rose Hill	
Knox	Fabius and Fabius River	According to Eaton: "Name derived from the Spanish word 'faba', a pea or bean, and the river so named because on its banks originally grew wild peas which were good early pasture for the horses of the explorers."[6]
	Hedge City	From the fence of Osage Orange commonly called hedge.
	Locust Hill	
Laclede	Hazel Green	Probably named for the Hazelnut (Corylus).
	Oakland	
Lawrence	Orange	
	Red Oak	
Livingston	Avalon	Named for the town of "Avallon" in France. It is a Celtic word meaning "apple tree." The town is noteworthy also as being the birthplace of the American botanist, Paul C. Standley.
McDonald	Pineville	So named from the pine lands near by; it was the seat of the "pine war."
Marion	Oakwood	
Mississippi	Buckeye	Named for the Ohio Buckeye *(Aesculus glabra)*.
Montgomery	Bellflower	From the variety of apple of that name.
Ozark	Locust	
	Sycamore	
Pemiscot	Cottonwood Point	

Furnace Company acquired vast amounts of timber land, either by ownership or lease, all situated in the west end of Iron County. What is now Viburnum was located fairly well in the central part of these lands, and a practicing physician, Dr. J. C. Mincher, thought it well to establish a town. He submitted three names—Lone Pine, Viburnum, and the third we have been unable to ascertain. Inasmuch as the Doctor was partial to Viburnum, because of the medical qualities of the Black Haw, this name was chosen. This was about 1902 or 1903. During operation of the Sligo Furnace Company in cutting timber, the town was fairly lively, but at present consists of a postoffice and store, with eight or ten dwellings. The Doctor has been dead for several years but his widow survives him and lives at Viburnum."

[6]It is not certain just what kind of wild pea is indicated here. It may be either Apios, Amphicarpa, or Strophostyles; it is too far north of the known range of *Phaseolus polystachyus*.

County	Place Name	Origin of Name
Phelps	Blooming Rose	
Polk	Violet	
Putnam	Mapleton	
Ray	Crab Orchard	
Ripley	Acorn	
	Pine	
St. Charles	Black Walnut	
	Cedar Pyramid	From a promontory which stands out at a distance of 12–15 feet in front of a great cliff in the bottom, and for many years had a cedar tree growing on its top.
St. Louis	Maplewood	
	Oakland	
	Old Orchard	From an apple orchard that occupied the original site.
	Pinelawn	
	Pinewood	
	Royal Oak	
Shannon	Birch Creek	From the birch trees *(Betula nigra)* that grew along its bank.
	Birch Tree	Named from a small grove of birch trees (the only ones for miles around) that stood near the site of the first postoffice, about two miles down Birch Creek from its present site.
	Cedar Grove	
	Pinegrove	
Shelby	Cherry Box	
	Oak Dale	Named from the many fine oaks along a dale near by.
Stoddard	Acorn Ridge	
	Bloomfield	Named because at the time the land was platted it was covered with flowers.
	Charteroak	
Taney	Cedar Creek	
	Cedar Valley	
	Pine Top	
	Walnut Shade	
Wright	Cedar Gap	Named for the cedar trees growing in the gap.

NOTES

Recent visitors to the Garden include Dr. Emilio Willems, of the University of Sao Paulo, Brazil, and Visiting Professor Dept. Sociology and Anthropology, Vanderbilt University, Nashville, Tenn.; Mr. Jan de Graaff, Head of Oregon Bulb Farms, Sandy, Oregon; Mr. Henry Allen Moe, Director General, Guggenheim Memorial Foundation; Mr. John O. Taylor, of the Botanical Gardens, Christchurch, New Zealand; Mr. William G. Hassler, of the Nashville Children's Museum, Nashville, Tenn.

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Missouri Botanical Garden Bulletin

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WILD ORCHIDS OF MISSOURI

JULIAN A. STEYERMARK

When orchids are mentioned in connection with Missouri, most people think immediately of the exotic plants growing in greenhouses at the Missouri Botanical Garden. Yet the wild orchids found throughout Missouri are both varied and interesting. Altogether thirty-two different kinds have been found, and one of them, the Showy Lady's Slipper *(Cypripedium reginae)* is among the most beautiful of all wild flowers in the United States.

Practically none of Missouri's wild orchids are very common, but the following eight species are very rare, being found in but one county: the Green Wood Orchid *(Habenaria clavellata)*, Large Whorled Isotria *(Isotria verticillata)*, *Isotria medeoloides*, Helleborine *(Epipactis latifolia)*, Rose Pogonia *(Pogonia ophioglossoides)*, Downy Rattlesnake Plantain *(Goodyera pubescens)*, Yellow Coral-root *(Corallorrhiza trifida* var. *verna)*, and Loesel's Twayblade *(Liparis Loeselii)*. Of these, the Downy Rattlesnake Plantain was first discovered in Missouri in 1928; Loesel's Twayblade in 1936; and just last year the Rose Pogonia was discovered by Mr. Bill Bauer. With additional exploration, other species may possibly be added to Missouri's list. Only three of these species known from but one county have ever been recollected since their discovery. *Isotria medeoloides (I. affinis)*, described as a new species in 1867, is one of the rarest orchids in the United States. Its sole Missouri record is based upon a collection made in 1898 by Mr. Colton Russell, near Glen Allen, Bollinger County, and preserved in the Herbarium of the Missouri Botanical Garden. The writer has twice visited the area in hope of re-discovering this species, each time without success. It is said to be partial to level ground in rich, deciduous forest not subject to inundation.

One of the smallest and most inconspicuous of the wild Missouri orchids is the Adder's-mouth *(Malaxis unifolia)*. Rising just a few inches above the surface of the ground and with a single pale green clasping leaf surmounted by a slender column of tiny green flowers, it blends so well with the surrounding dense foliage and underbrush that it is with difficulty singled out.

The showiest of the wild orchids in Missouri belong to the Lady Slipper clan (Cypripedium). There are four different species in Missouri, of which *Cypripedium reginae* (Showy Lady's Slipper) is undoubtedly the most beautiful. It is very rare and mostly found in the southern Ozark region, growing on shaded limestone bluffs where the water seeps out during the year. In the northern states it usually inhabits tamarack or white cedar swamps or swales in sand dunes. Unlike the other Lady's Slippers in Missouri which show a marked preference for acid soils, the Showy Lady's Slipper prefers limey to

Showy Lady's Slipper *(Cypripedium reginae)* on limestone bluff in Howell County.

Showy Lady's Slipper growing wild in Ozark County.

neutral situations. It also blooms somewhat later than the others, starting about the middle or end of May and continuing throughout the first two weeks in June. In the northern states it blooms about a month later than this. Usually the Yellow Lady's Slipper *(Cypripedium Calceolus* var. *parviflorum)* comes into flower in Missouri as early as the last part of April. The Small White Lady's Slipper *(Cypripedium candidum)*, a very rare species in the state, flowers at about the same time, sometimes a week or two later.

Many Missourians who think of the Ozarks as a haven for wild flowers

will be surprised to learn that the Yellow Lady's Slipper is much more common and abundant in the northern half of the state. The writer has seen hill slopes in various parts of northern Missouri covered with hundreds of beautiful blossoms of this species, while in the Ozarks they are at best found scattered here and there. Similarly, the Showy Orchis *(Orchis spectabilis)* and Large Twayblade *(Liparis lilifolia)* seem to occur in greater concentration in northern Missouri. Here fifty or more plants of these species may be encountered in a favored locality as compared with only one to a few in the Ozarks.

Although in the tropics a number of species of orchids may be found in bloom at different times of the year, probably the majority of them come into bloom during the dry season, especially at its beginning or end. Our native Missouri orchids also have their special blooming season. The latter part of March starts off the orchid parade in Missouri with the Coral-root *(Corallorrhiza Wisteriana)*. In April comes the Showy Orchis (*Orchis spectabilis)* and Yellow Lady's Slipper *(Cypripedium Calceolus* var. *parviflorum)*. One of the Ladies' Tresses, the rare *Spiranthes lucida*, may be found during May and the first part of June in moist places such as near small spring-fed streams and on rocky ledges near water. In July the slender columns of small, white hooded blossoms of the Downy Rattlesnake Plantain *(Goodyera pubescens)* become evident, but only where the La Motte sandstone outcrops in Ste. Genevieve County. In that same month there suddenly springs into bloom the lovely rose-colored flowers of the recently discovered Rose Pogonia *(Pogonia ophioglossoides)*, lurking practically hidden in one swampy meadow in Reynolds County. The hot summer months may find the Crested Coral-root *(Hexalectris spicata)* in bloom in rich woodlands and cedar banks. This orchid, like other so-called Coral-root orchids (Corallorrhiza), is saprophytic and destitute of any green coloring. All other Missouri orchids have one or more green leaves at some stage of their growing period. The Adam-and-Eve orchid *(Aplectrum hyemale)* is the most remarkable, however, for in late autumn it sends up a solitary, ribbed, dark green, Aspidistra-like leaf that remains evergreen throughout the winter. The flowers appear in May and June, and may or may not be accompanied by the leaf. Most frequently the leaf has already died down to the ground by the time the flower stalk appears.

The Ladies' Tresses clan (Spiranthes) accounts for most of the autumn orchid display in Missouri. As late as November members of this genus may be in evidence. The smallest of the group, Little Ladies' Tresses *(Spiranthes Grayi* [S. *Beckii*]*)*, has a solitary, elongated tuberous root and a spiral row of small white flowers, while the Slender Ladies' Tresses *(*S. *gracilis)* has usually a pair of tuberous roots and somewhat larger flowers. Both grow commonly in dry, acid, thin soils on open oak-hickory ridges and flat upland

Yellow Lady's Slipper
(Cypripedium Calceolus var. *pubescens)*

expanses of forest. The Nodding Ladies' Tresses *(S. cernua)*, one of the commonest of Missouri orchids, is similar to the two preceding, but has much larger and showier, several-ranked spikes of white flowers, and a cluster of several, elongated, tuberous roots. Instead of the woodland habitat of the other Spiranthes, it chooses open sunny places, either in prairies, meadows, or rocky glades. It is very commonly encountered on limestone "barrens." These autumnal Ladies' Tresses send up their flowering stalks mostly unaccompanied by leaves. The leaves may be seen as rosettes earlier in the year during the wet spring months, but later on wither and die to the ground. After a short resting season, the solitary erect flower spike suddenly appears above the ground. Another late-autumn orchid is the delicate Nodding Log Orchis *(Pogonia trianthophora)*. It usually is found in rich bottom woods and often is associated with decaying logs. Its delicate tuberous root anchors the slender stem loosely just beneath the surface of the ground, near rotting logs and leaves, usually where decaying humus and fungous growth abound.

WILD ORCHIDS ON GARDEN GROUNDS

LOUIS G. BRENNER

Most people know that the main body of the Garden orchid collection is housed in the greenhouses at the Arboretum, but few realize that in the forest preserve of the Arboretum and nearby meadow, and also on the rich loessal hills of Hidden Valley, several interesting species of native orchids may be found. Among these are the Crested Coral-root *(Hexalectris spicata)* growing in the Red Cedar Brakes in August, Nodding Ladies' Tresses *(Spiranthes cernua)* found on the glades in September to late October, and Slender Ladies' Tresses *(Spiranthes gracilis)* abundant in the upland meadows in the late summer and early autumn. At Hidden Valley, near St. Albans, Mo., the Coral-root Orchid *(Corallorrhiza wisteriana)* is found in spring in considerable numbers. The Small Yellow Lady's Slipper *(Cypripedium Calceolus* var. *parviflorum)*, introduced into the forest preserve of the Arboretum in 1940, is established and has been blooming for the past several springs. It is hoped that with the reconstruction of a rich, deep, forest mold, and the maturing of the forest trees, more species of native orchids might be successfully introduced to make our Garden grounds the center for the most comprehensive collection of native orchids as well as for an already-famous collection of exotic species and hybrids.

ORCHIDS IN THE HOME

GUSTAV A. L. MEHLQUIST

Since the middle of the last century orchids have been the aristocrats of the greenhouse and conservatory. This is readily understandable as the exotic beauty of these tropical and subtropical plants has no counterpart among the plants found in the temperate zones.

Naturally the question is often asked whether orchids can be grown in the home. The question is not one that can be answered yes or no without qualification, for home conditions vary considerably especially with regard to temperature and humidity. In general, it may be said that the average home is kept too warm at night and that the relative humidity is too low during the winter season. Orchids coming as they do from many different climatic regions naturally vary as to their requirements with respect to heat, humidity, and many other things but generally those requiring the highest night temperatures (around 60–65° or even 70° F.) also require the highest humidity and conversely those that can get along with a relatively low humidity require also a relatively low night temperature (50–60°). In other words, those that could get along with the relatively high temperatures maintained in most thermostatically controlled homes require more

humidity than is likely to prevail and those that are adapted to lower humidity require lower night temperatures than are ordinarily maintained. However, many homes today have humidity control as well as temperature control and when it is realized that a humidity higher than that of the average home during the winter gives a sensation of greater comfort to human beings as well as providing better conditions for house plants, humidity control in the home will be more generally appreciated. In the meantime, any one contemplating growing orchids in his home will have to choose his plants with care and do what he can toward providing suitable conditions. Judging from the ingenuity, skill, and perseverence displayed in raising such plants as African Violets (Saintpaulia) and many kinds of Begonia, there is little reason to doubt that a determined amateur gardener with a green thumb could grow certain orchids in his home should he so desire.

Many would-be orchid growers are perplexed about what to grow the plants in, the assumption being that all orchids are parasitic and therefore must have special composts. Actually orchids are not parasitic, but most of the tropical genera are epiphytic (from *epi*, meaning upon, and *phyte*, plant); that is, they attach themselves to the bark of suitable tree species, and with part of their root system in the bark and the rest of it hanging free in the air they eke out a meager existence by living on the minerals available in the bark or those brought down by tropical rain. When orchids were first introduced to horticulture, attempts were made to grow them on pieces of logs with bark attached or in clumps of fern roots fastened to a piece of wood that could be suspended from the roof of the greenhouse. However, it was soon found that the plants could be grown as well and more conveniently in pots. After trying a great number of materials it was found that the majority of the epiphytic orchids could be grown well in a mixture consisting largely of fern roots. Today orchids are usually grown in so-called osmunda fiber, which is simply the roots of the Osmunda fern which is to be found in swampy areas of the eastern United States. A little sphagnum moss is often added, and for the terrestrial orchids (growing on the ground) often a little turfy loam and leaf mold, but the osmunda fiber is the main ingredient. One reason for the widespread success with osmunda fiber is undoubtedly the fact that with proper watering it retains a favorable acidity level in the pots (most orchids are acid-loving plants) while it slowly decays. During the process of decay it provides the necessary nutrients at a rate suitable to a diversity of orchids.

During the war and the years immediately after, many attempts were made to grow orchids in other media than osmunda fiber which had become both scarce and high-priced. Now that it is again available, though somewhat expensive, many growers have gone back to it while others prefer to

use some of the "newer" materials. These materials range from such inorganics as cinders, haydite, gravel, or granite chips to organics such as leaf mold, peat moss, sphagnum moss, and tanner's bark. Probably not all of these materials have been used by any one grower, since the selection of suitable potting compost depends not only on the kind of orchid to be grown but also on whether nutrient solutions are to be used in order to speed up the growth.

Nutrient solutions are required when the plants are grown in the non-organic media but are often also beneficial when the organic media are used. In general, it can be said that members of the Cattleya group (Cattleya, Brassavola, Epidendrum, and Laelia) have been grown as well in inorganic materials whereas members of the Cymbidium and Cypripedium groups have not yet been very successfully grown in any inorganic medium. Since the latter groups are the ones that have lent themselves best to other organic materials than osmunda fiber, this circumstance has proved no particular hardship. Most orchids that are commonly seen in collections are acid-loving plants, and require a compost that is rather on the acid side. Although it is possible to regulate the acidity by means of several chemicals it is usually better to use a compost of the proper acidity and to use chemicals only to supplement the nutrient value of the compost. Ordinarily, an acidity level of pH 5–6 or even 6.5 will suit most orchids (pH 7 being neutral). Good quality osmunda fiber usually is quite acid, testing from pH 4 to 5.5. Peat moss, sphagnum moss, and oak or beech leaf mold usually run from about pH 4.5 to 6. Tanner's bark and similar materials sometimes available may run from pH 5 all the way to pH 7. The figures are those of the standard pH scale universally used today in measuring acidity.

In using osmudine it is absolutely necessary to learn the proper technique of potting so that a uniformly firm pack be obtained throughout the pot, otherwise the osmudine will retain too much water and decompose too quickly. As this potting technique requires experience and strong hands many amateurs favor composts that are easier to handle. Now this is the point at which all semblance of agreement among growers breaks down. However, good results may be obtained with so many variations in proportions and kinds of materials that I shall merely list those mixtures that I have found useful and not make any claim whatever that they could not be improved upon.

As already stated, members of the Cattleya group can be grown to perfection in purely inorganic materials. So much has been written on this subject and the technique is so well covered in the references listed at the end of this article that it will not be further discussed here except to point out that work done in various parts of this country indicates that the

PAPHIOPEDILUM GAUDIANUM
An interesting hybrid of HARRISSIANUM parentage
(*P.* HARRISIANUM × *P. Curtisii*)

nutrient solutions need not be nearly as strong as was formerly thought. Excellent results have been obtained by using solutions of about $\frac{1}{10}$ the concentrations recommended for other plants. The orchid is a slow growing plant at best and cannot be made to grow as rapidly as tomatoes and carnations. The same is true when nutrient solutions are used to supplement the nutrients in the various organic composts used for Cymbidiums and Paphiopedilums (Cypripediums). With these genera a very weak nutrient solution applied occasionally when the plants are in active root growth is usually beneficial but stronger solutions often produce severe injury.

In growing the true epiphytic genera such as Cattleya, Brassavola, Epidendrum, Laelia, and Phalaenopsis, splendid results have been obtained with chopped osmunda fiber and ½ granite chips or non-calcareous gravel. The

Left, CYMBIDIUM PUMANDER *(P. pumilum* × LUIS SANDER*)*; right, C. MINUET *(C. insigne* × *pumilum)*.

weight of the gravel causes the mixture to pack itself, and all that is necessary is to get it around the roots evenly. The nutrient solution (1/10 standard strength) is then applied weekly or every two weeks when the roots of the plants are active. The osmunda fiber should be moistened before it is chopped, then run over a 1/2-inch mesh screen. All that goes through should be discarded or used for something else.

Cymbidiums do very well in a mixture of equal parts of chopped osmunda fiber, oak leaf mold, and oak shavings or tanner's bark. Being semi-terrestrial a small amount of bone-meal or well-rotted manure is beneficial. The osmunda fiber should not be chopped too finely and need not be screened. As this mixture is rather spongy it should be packed firmly around the roots. Paphiopedilums do well in a mixture of coarse oak leaf mold, and osmunda, with a little sphagnum moss added. If oak leaf mold is not available, a

mixture of ¾ or ⅘ shredded osmunda and the rest sphagnum moss will do. The osmunda in this case should not be chopped but shredded or pulled apart —a job which can readily be done after the fiber has been moistened and allowed to lay overnight. Separating dry osmunda is not only hard on the hands but produces a very irritating dust.

Most tropical orchids require partial shade. It is very difficult to state just how much, for this is dependent in part on the temperature and in part on the relative humidity. In general, it may be said that all the orchids mentioned so far require somewhat more light than do flowering Saintpaulias and foliage Begonias. Anyone with some aptitude for plant growing soon learns to recognize the gradual yellowing of the foliage that is due to too strong light, and will change the conditions before any real damage is done.

LIST OF ORCHIDS SUITABLE FOR THE HOME*

	Night temperature	Day temperature	Remarks
Brassavola glauca	60°	65–80°	
nodosa	60°	65–80°	
Cattleya Bowringiana	60°	65–80°	
Mossiae	60°	65–80°	
Skinneri	60°	65–80°	
Trianaei	60°	65–80°	
Cymbidium PAUWELSII	50–55°	65–80°	Hybrids
MADELEINE	50–55°	65–80°	
BUTTERFLY	50–55°	65–80°	
Any hybrid involving the species *erythrostylum* and *pumilum* has good possibilities	55–60°	65–80°	
Epidendrum O'Brienianum	60°	65–80°	Will take almost full sun
radicans	60°	65–80°	
Laelia anceps	55–60°	65–80°	
Primary hybrids between Laelia and Cattleya are good possibilities	60°	65–80°	
Paphiopedilum barbatum	60°	65–80°	
callosum	60°	65–80°	
Lawrenceanum	60°	65–80°	
All hybrids between these	60°	65–80°	
HARRISIANUM	55–60°	65–80°	Hybrid— many types in this class
insigne	50–55°	65–70°	
Hybrids between *insigne* and *Spicerianum* and *villosum*	55–60°	65–80°	
Phalenopsis Shilleriana	60–65°	65–80°	Require about as much shade as Saintpaulia
hybrids	60–65°	65–80°	

*The names indicated in italics are species; those in caps are hybrids.

Ordinarily, orchids suffer more severe damage from too much light than from too little, although too little may keep the plants from blooming regularly.

The water requirements of orchids vary so much with the species, the potting mixture, and the conditions under which the plants are grown that no definite schedule can be suggested. Frequent overhead syringing with lukewarm water, especially in the firing season, and occasional heavy watering of the compost is usually the answer to this question. As with other plants, the grower has to learn the individual requirements of the species he is interested in.

Since it is dangerous, or at least impractical, to use in the home the newer powerful insecticides now widely used in greenhouses to control scale, mealy bugs, thrips, and red spider mite, every precaution should be taken to secure plants that are free from these insects. If, nevertheless, insects do appear, sponging the affected parts with lukewarm water to which a small amount of nicotine sulphate and soap has been added will usually get rid of them.

As has already been said, it is a most difficult task to make definite recommendations as to genera and species of orchids that will grow in the home. Above is a list of species that are among the easiest to grow and reasonably well adapted to house culture. Eventually the orchid enthusiast will realize how many more species and hybrids can be grown in a small greenhouse built for this purpose. Inexpensive models that can be attached to the home or built separately are now advertised in most gardening magazines. The list of orchids is strictly for beginners, but all of these species and hybrids are worth growing. For descriptions see the following references:

1. Logan, H. B., and Lloyd C. Casper. Orchids are Easy to Grow. Ziff-Davis Publ. Co., Chicago.
2. Northen, Rebecca T. Home Orchid Growing. Van Nostrand Co., New York.
3. Watkins, J. V. ABC of Orchid Growing. Ziff-Davis Publ. Co., Chicago.
4. White, E. A. American Orchid Culture. A. T. De La Mare Publ. Co.

THE YELLOW IN THE EARLY SPRING LANDSCAPE

JULIAN A. STEYERMARK

The Missouri countryside during late March or early April looks more or less barren and still suggestive of a bleak winter. But here and there, breaking the black monotony of leafless branches, there stand out striking patches of yellow which become more predominant as one travels south from St. Louis. Long before the rose-pink of the Redbud or the conspicuous white of the Flowering Dogwood appear, the yellow-flowering shrubs and trees are putting on their own special show. Unfortunately, most people miss this beautiful display of yellow because the usually blustery, rainy, or otherwise unsettled weather during late March is not conducive to outings.

Six yellow-flowered native shrubs or trees and one cultivated shrub may

be seen in bloom at this time. They are: Goldenbell *(Forsythia* spp.*)*, Sassafras *(Sassafras albidum)*, Swamp Privet *(Forestiera acuminata)*, Leatherwood *(Dirca palustris)*, Fragrant Sumac *(Rhus aromatica)*, and the Spicebushes *(Lindera Benzoin* and *L. melissaefolium)*. Each has a distinctive appearance and can be readily recognized even from a comfortable seat behind the driving wheel. Not only does the yellow color differ in shade and intensity, but the position and abundance of the color masses and the size of the plant are characteristic.

Curiously enough, the autumn-flowering Witch Hazel *(Hamamelis virginiana)*, also possesses the pale yellow color of these early spring-flowering species. Its flowers may be seen in the forest of the southeastern Ozarks hanging on to the bare branches between the middle of September until January, well after the forest leaves have been shed.

Forsythia.—The Goldenbell or Forsythia can be recognized easily from a distance by its large lemon-yellow or butter-yellow flowers, more or less uniformly abundant upon all the branches. Since it is a cultivated shrub, it is usually found around houses or near human habitation.

Sassafras.—Sassafras being a tree is in general much taller than any of the other species mentioned. Its loose clusters of medium-sized pale yellow or greenish-yellow flowers at the tips of short upright twigs serve to distinguish it.

Swamp Privet.—The Swamp Privet is common in swampy ground or along river banks in the southeastern lowlands and the southern Ozarks. It has small, tight, button-like clusters of mustard-yellow or greenish-yellow flowers uniformly set along the branches. The flower clusters are more abundant and more uniformly arranged than in any of the other species.

Leatherwood.—The Leatherwood has the smallest proportion of flowers of any of the shrubs listed. This is due to the slow-growing, rather sparsely branching habit of the plant. The species inhabits rich valley bottoms or slopes along streams or forested bluffs.

Fragrant Sumac.—The lemon-yellow color of the Fragrant Sumac is similar to that of the two kinds of Spicebush. However, the flowers are less abundant and are arranged in small oblong heads that stand up and away from the branches. The Fragrant Sumac is usually found in dry open woods, thickets, or rocky slopes.

Spicebush.—Only one of the Spicebushes *(Lindera Benzoin)* is commonly encountered. The other *(Lindera melissaefolium)*, a more southern species and known to occur in only a limited section of the swampy region of Ripley County south of Naylor, is of much lower stature, with more slender twigs and fewer branches.

The following key is offered for field identification of the yellow-flowered ligneous spring species discussed above:

A. Individual flowers large and bell-shaped, bright rich yellow; cultivated shrub near human habitation..... Goldenbell (*Forsythia* spp.)

AA. Individual flowers small, pale yellow, lemon-yellow, or greenish-yellow; wild shrubs or trees.

B. Trees; flowers greenish-yellow, in loose clusters at the tips of short upright twigs; glades, thickets, fence-rows, fields, and woodland, mostly in dry sterile soils..... Sassafras (*Sassafras albidum*)

BB. Mainly shrubs; flowers pale yellow, lemon-yellow, or mustard-yellow, in small compact clusters or suspended from the branches.

C. Flowers tubular, in scattered few-flowered clusters hanging from the sides of straggly, sparsely branched, zigzag twigs; rich wooded valleys and rocky wooded slopes..... Leatherwood (*Dirca palustris*)

CC. Flowers like small stars, in button-like to oblong masses arising directly from the twigs.

D. Flowers in few oblong head-like masses terminating the twigs; dry open woods, thickets, and rocky open slopes.. Fragrant Sumac (*Rhus aromatica*)

DD. Flowers in small rounded clusters appearing to sprout directly from the twigs, but not erect.

E. Branches and flower clusters in opposite pairs; forking of branches regular, giving symmetrical, rounded appearance to shrub; southeastern Missouri swamps, river bottoms of Mississippi, St. Francis, White and other southwestern Missouri rivers..... Swamp Privet (*Forestiera acuminata*)

EE. Branches and flower clusters alternately arranged; branching irregular.

F. Commonly encountered; large shrub 5–14 feet tall; conspicuous branching..... Spicebush (*Lindera Benzoin*)

FF. Known only from swamps south of Naylor, Ripley County; low shrub, 2–6 feet tall; branching sparse.. Spicebush (*Lindera melissaefolia*)

QUINTENNIAL REPORT ON SPRING

ROBERT W. SCHERY

Since the recent war it has been my pleasure to observe the advent of spring in St. Louis as expressed in the flowering of outdoor plants at the Garden. Each year in April a few pages of the BULLETIN have been devoted to this "annual report" on springtime, now in its fifth successive year.

As the records accumulate (see chart) it becomes apparent how unusually early was the spring of 1946. Once flowering started that year it continued with scarcely a break and was full-fledged before the middle of March. No wonder that botanists from the East and North attending the science meetings in St. Louis in March of that year were amazed at the beauty and precociousness of a St. Louis spring. Evidently, on the basis of subsequent record, St. Louisans may well have been amazed too, for not since has a spring even approached 1946.

FIVE-YEAR RECORD OF SPRING FLOWERING DATES

Plant	First flowering					1950 flowering dates compared with	
	1950	1949	1948	1947	1946	late spring (1947)*	early spring (1946)*
Snowdrop *(Galanthus nivalis)*	Jan. 23	Feb. 13	Mar. 2		Feb. 27		+35
Crocus, early yellow *(Crocus* sp.)	Jan., late	Feb. 13	Mar. 2				
Silver maple *(Acer saccharinum)*	Jan., late	Feb. 21	Feb. 28	Mar. 24	Feb. 11	+52	+12
Chickweed *(Stellaria media)*	Feb. 20	Mar. 23	Mar. 24	Apr. 1	Mar. 5	+39	+13
Crocus, large blue *(Crocus* sp.)	Feb. 28	Mar. 4	Mar. 17				
Cornelian cherry *(Cornus Mas)*	Feb. 28	Mar. 5	Mar. 17	Mar. 18	Feb. 28	+18	0
Fragrant Honeysuckle *(Lonicera fragrantissima)*	Feb. 28	Mar. 7	Mar. 18	Mar. 24	Feb. 28	+24	0
Elms *(Ulmus* spp.)	Mar. 7	Mar. 5	Mar. 17	Mar. 24	Feb. 18	+17	−17
Hazel, European *(Corylus avellana)*	Mar. 7	Mar. 5	Feb. 29	Mar. 24		+17	
Goldenbell *(Forsythia* spp.)	Mar. 7	Mar. 7	Mar. 21	Apr. 2	Mar. 4	+26	− 3
Daffodils *(Narcissus* spp.)	Mar. 17	Mar. 21	Mar. 21	Apr. 2		+16	
Japanese Andromeda *(Pieris japonica)*	Mar. 18	Mar. 22	Mar. 22	Apr. 1	Mar. 18	+14	0
Periwinkle *(Vinca minor)*	Mar. 23	Mar. 24					
Glory-of-the-snow *(Chionodoxa* spp.)	Mar. 23	Mar. 26					
Spice Bush *(Lindera Benzoin)*	Mar. 26	Mar. 25					
Grape Hyacinth *(Muscari sp.)*	Mar. 27	Mar. 29	Apr. 3				
Magnolia, Star *(Magnolia stellata)*	Mar. 27	Mar. 27	Mar. 24	Apr. 7	Mar. 5	+11	−22
Magnolia, Saucer *(Magnolia Soulangeana)*	Mar. 28	Mar. 29	Mar. 24	Apr. 7	Mar. 5	+10	−23
Plum *(Prunus* spp.)	Mar. 28	Mar. 31	Apr. 1	Apr. 7	Mar. 4	+10	−24
Shepherd's Purse *(Capsella bursapastoris)*	Mar. 28	Mar. 29	Mar. 22				
Sumac, aromatic *(Rhus aromatica)*	Mar. 31	Mar. 28	Mar. 22	Apr. 7	Mar. 21	+ 7	−10
Oreg. Grape-holly *(Mahonia aquifolium)*	Mar. 31	Mar. 31					
Henbit *(Lamium amplexicaule)*	Mar. 31	Mar. 31					
Cottonwood *(Populus deltoides)*	Apr. 6	Mar. 30	Mar. 26	Apr. 7	Mar. 21	+ 1	−16
Boxelder *(Acer Negundo)*	Apr. 6	Mar. 31	Mar. 26	Apr. 7	Mar. 8	+ 1	−29

*Plus sign indicates days earlier; minus sign days later.

Plant	First flowering					1950 flowering dates compared with	
	1950	1949	1948	1947	1946	late spring (1947)*	early spring (1946)*
Purple crabapple *(Malus purpurea)*	Apr. 9						
Wintergreen barberry *(Berberis julianae)*	Apr. 10						
Ash *(Fraxinus* sp.*)*	Apr. 11	Apr. 6	Apr. 3	Apr. 7	Mar. 18	— 4	—24
Norway maple *(Acer platanoides)*	Apr. 11	Apr. 6	Apr. 3	Apr. 7	Mar. 24	— 4	—18
Sassafras *(Sassafras albidum)*	Apr. 11	Apr. 5	Apr. 6	Apr. 21	Mar. 18	+10	—24
Gooseberry *(Ribes aureum)*		Apr. 7	Apr. 7	Apr. 21			
Redbud *(Cercis canadensis)*		Apr. 8	Apr. 6	Apr. 25	Mar. 6		
Japanese barberry *(Berberis thunbergii)*		Apr. 13	Apr. 14				
Viburnum *(Viburnum Carlesii)*		Apr. 13	Apr. 13				
Lilac, common *(Syringa vulgaris)*		Apr. 13	Apr. 7	Apr. 27	Mar. 26		
Hawthorn *(Crataegus* sp.*)*		Apr. 15	Apr. 15	May 1			
Swamp privet *(Forestiera acuminata)*		Apr. 16	Apr. 18	Apr. 29			
Storax *(Styrax* sp.*)*		Apr. 18	Apr. 18	May 4	Mar. 27		
Willow *(Salix nigra)*		Apr. 18	Apr. 18	Apr. 29	Apr. 5		
Buckeye *(Aesculus* sp.*)*		Apr. 18	Apr. 15	Apr. 27	Mar. 27		
European birch *(Betula pendula)*		Apr. 18	Apr. 9	Apr. 20			
Pea-shrub *(Caragana arborescens)*		Apr. 20	Apr. 13				
Xanthoceras *(Xanthoceras sorbifolia)*		Apr. 21	Apr. 13				
Hackberry *(Celtis occidentalis)*		Apr. 22		Apr. 30	Mar. 24		
Silverbell *(Halesia carolina)*		Apr. 22	Apr. 18	May 3	Mar. 30		
Oaks, various *(Quercus* sp.*)*		Apr. 22	Apr. 10	Apr. 27	Apr. 1		
Paper mulberry *(Broussonettia papyrifera)*		Apr. 25	Apr. 25	May 3			
Sweetgum *(Liquidambar styraciflua)*		Apr. 25	Apr. 19	May 2	Mar. 30		
Fleabane *(Erigeron* sp.*)*		Apr. 26	Apr. 20	May 4	Apr. 20		
Mulberry *(Morus* sp.*)*		Apr. 26	Apr. 18	May 1	Apr. 2		
Bluegrass, Kentucky *(Poa pratensis)*		Apr. 26	Apr. 20	Apr. 28	Apr. 5		
Locust, Kelsey *(Robinia kelseyi)*		Apr. 30	Apr. 27	May 13	Apr. 15		

Spring in 1950, following one of St. Louis' mildest winters, started even earlier than in 1946. Snowdrops (they even had their picture in the paper for precociousness), early Crocus, and maples started flowering sporadically toward the end of January. But some of the most miserable weather of the winter, in February and March, then held flowering in check until all hope of matching 1946 was gone. Instead spring 1950 has started the new half-century in a rather "usual" fashion, more or less matching in flowering times the springs of 1949 and 1948, and in April delayed to about the 1947 pace.

Brief warm spells in late February and March 6–7 brought a number of early plants into bloom, but in general blooming was very sporadic until the unusually warm weather of March 25–28. It was then that magnolias began to pop, forsythia reached full glory, daffodils bloomed in profusion, and the leaves of shrubs began to appear. Thus, to most folk botanical springtime probably blustered into St. Louis the last week of March, accompanied by abundant sunshine and the foreboding smell of dust once again rising from our Great Plains.

For readers who wish to compare flowering time of selected spring-blooming plants for the last 5 years, the chart listing dates is given. As in charts of previous years, flowering time has been interpreted to be full expansion and opening of the perianth, or, in those flowers lacking petals, the appearance of mature pollen. For comparison with our earliest (1946) and latest (1947) springs of the last 5 years, the two columns to the right list number of days difference in flowering time.

A NEW FOLIAGE PLANT FROM PANAMA

(GUZMANIA MUSAICA var. ZEBRINA)

LADISLAUS CUTAK

On September 23, 1946, a shipment of eleven young specimens of a highly ornamental bromel arrived at the Garden from Panama, which had been collected by Mr. Paul H. Allen, Tropical Plant Collector for the Missouri Botanical Garden. The plants bore a striking resemblance to the rare *Vriesia splendens*, popularly dubbed "convict plant" because of the conspicuous stripes on its leaves. While the stripes of *Vriesia splendens* are definitely solid, those of the Panamanian plant are composed of more or less distinct lines. Moreover, *Vriesia splendens* is native to French and British Guiana and supposedly is not widely distributed even in those two South American countries.

The only other plant known to the writer which exhibits this peculiar pencilling is *Guzmania musaica*. Since that species occurs in several localities in Panama, it was readily assumed that Allen's plants might be related to it.

Guzmania musaica (left) and its variety *zebrina* (right), showing the distinguishing character of the leaf stripes.

Some Thecophyllums are also very densely marked with faint wavy transverse lines but our plants had more of the characteristics of Guzmania.

Last December, two of Allen's plants bloomed. Cursory examination of the floral spike showed the *Guzmania musaica* affinity but the foliage was obviously different. A search of the literature revealed no identical plant, and after consultation with Dr. Lyman B. Smith, the foremost monographer of the Bromeliaceae today, it was decided to name this bizarre variety in order to distinguish it from the species.

Guzmania musaica was discovered by Gustavus Wallis in New Granada, now known as the Republic of Colombia. This botanical explorer stated in *Gardeners' Chronicle*, November 21, 1874, that he found this plant in December, 1867, and sent it to Linden in 1868. Linden at that time was chief editor of the French journal *L'Illustration Horticole*, and a recognized authority on Bromeliaceae. With his co-worker, André, he described the plant as *Tillandsia musaica* in 1873 without seeing the flowers. In the next few years the plant was transferred into three or four other genera, including Billbergia, Caraguata, Massangea and Vriesia. Finally, in 1896, Mez placed it in Guzmania where it has rightfully remained.

Wallis again visited the same region in 1873 and remarked about having seen the plants bearing many fruits. A woodcut of the plant was first published in Bull's catalogue, and later this illustration was used in *Gardeners' Chronicle* and other horticultural magazines of the 1870's. Albert Bruchmüller, of Ocaña, Colombia, also collected *Guzmania musaica* and sent dried flowers, along with a sketch, to Mr. Bull. Report of its first flowering in Europe was in April, 1875, at which time William Bull exhibited it before the Royal Horticultural Society.

Guzmania musaica apparently develops a certain degree of variation, as Bruchmüller notes that some of them are light green and darkly variegated while others are of a brownish color. When looking at a typical *Guzmania musaica* and comparing it with Allen's plant one can readily recognize that the latter is quite distinct and would be much preferred by the plant connoisseur because of the prominent zebra-like markings. The illustrations clearly show this difference. The writer considers that the varietal name *zebrina* aptly describes Allen's remarkable plant.

GUZMANIA MUSAICA (Linden & André) Mez. var. **zebrina** Cutak, var. nov.

Speciei similis sed laminis foliorum valde et late fasciaris.—Similar to the species but with the blades of the leaves strongly and broadly banded.

Type in the Missouri Botanical Garden Herbarium. Collected on trees, north face of Cerro Pajita hills north of El Valle de Antón, Coclé Province, Panamá, 3400 ft. alt., Sept. 1946, *Paul H. Allen 3777*.

Plant 8 inches high and 16 inches broad (largest one examined), acaulescent. Leaves 12 or more in a spreading rosette, 8 inches or more long, marked on both sides with copious fine irregular vermiform transverse lines congested into prominent bands, those above Dark Dull Yellow-Green* on a Parrot Green (pale green) background, those below purplish to Taupe Brown on a bright green to purplish green ground. Sheaths short and indistinct, blades ligulate, broadly acute or rounded, apiculate, about 1½–2½ inches wide, margins slightly rolled back. Scape erect, shorter than the leaves, 8 inches long, pale greenish tinged with pink, covered with closely clasping, broadly elliptic, acuminate, Indian Lake (bright rose) bract-leaves. Flowers 11 or more, aggregated into a subglobose capitulum, each subtended by a large bright scarlet-rose, broadly obovate, coriaceous bract about half as long as the sepals and enfolding the base of the flower. Flowers subsessile, 1¼ inches long. Sepals 1¼ inches or more long, oblong to lanceolate, obtuse, cucullate, highly connate, coriaceous, glabrous, Ochraceous-Orange to Daphne Pink at the tips. Petals white, oblong, highly connate, shorter than the sepals. Stamens inserted in a single row at the throat of the corolla-tube, shorter than the petals. Filaments linear, about ⅛ inch long. Anthers about ¼ inch long. Ovary ovoid. Style elongated, ⅝ inch long; stigmas 3, oblong, not spirally twisted.

The new variety responds well to greenhouse culture and can be easily grown even on a windowsill if planted in a mixture of porous leaf mold and sand or orchid peat. Water must be kept in the leaf-cups and therefore a daily spray is desirable, especially where artificial heat is used. The plant may burn if subjected to intense sun and so is recommended for shady locations. This highly ornamental foliage plant is bound to become a great favorite although it will be some time before it becomes available in the trade.

*Color terms used are those of Ridgway's "Color standards and color nomenclature."

NOTES

The first number of Vol. 37 of the ANNALS OF THE MISSOURI BOTANICAL GARDEN, being Pt. 2 of Fasc. IV of Woodson and Schery's *Flora of Panama* ("Piperaceae of Panama" by T. G. Yuncker), was issued during March.

Recent visitors to the Garden include: Mr. E. L. Little, of the Forest Service, U. S. Dept. Agr.; Mr. Haskell Venard, of the Fuller County Botanical Garden, Atlanta, Ga.; Dr. A. J. Sharp, of the University of Tennessee, Knoxville; Dr. O. J. Sauer, of the Department of Geography, University of California, Berkeley; Dr. William L. Brown, of the Pioneer Hi-Bred Corn Co., Johnston, Iowa.

A party from the Garden consisting of the following taxonomists drove to Florida on a plant-collecting trip during the Easter holidays: Dr. Rolla M. Tryon, Mrs. Tryon, Dr. George van Schaack, Mr. David J. Rogers, Mr. George J. Freytag, Mr. Reno Alava, Mr. John Gillette, Mr. Robert Nevins.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 40,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until 7:00 p. m.; Sundays, 10:00 a. m. until 7:00 p. m. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah bus line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

THE MISSOURI BOTANICAL GARDEN

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MISSOURI BOTANICAL GARDEN BULLETIN

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Cover: Love-in-a-Mist, or Devil-in-the-Bush. From an old herbal.

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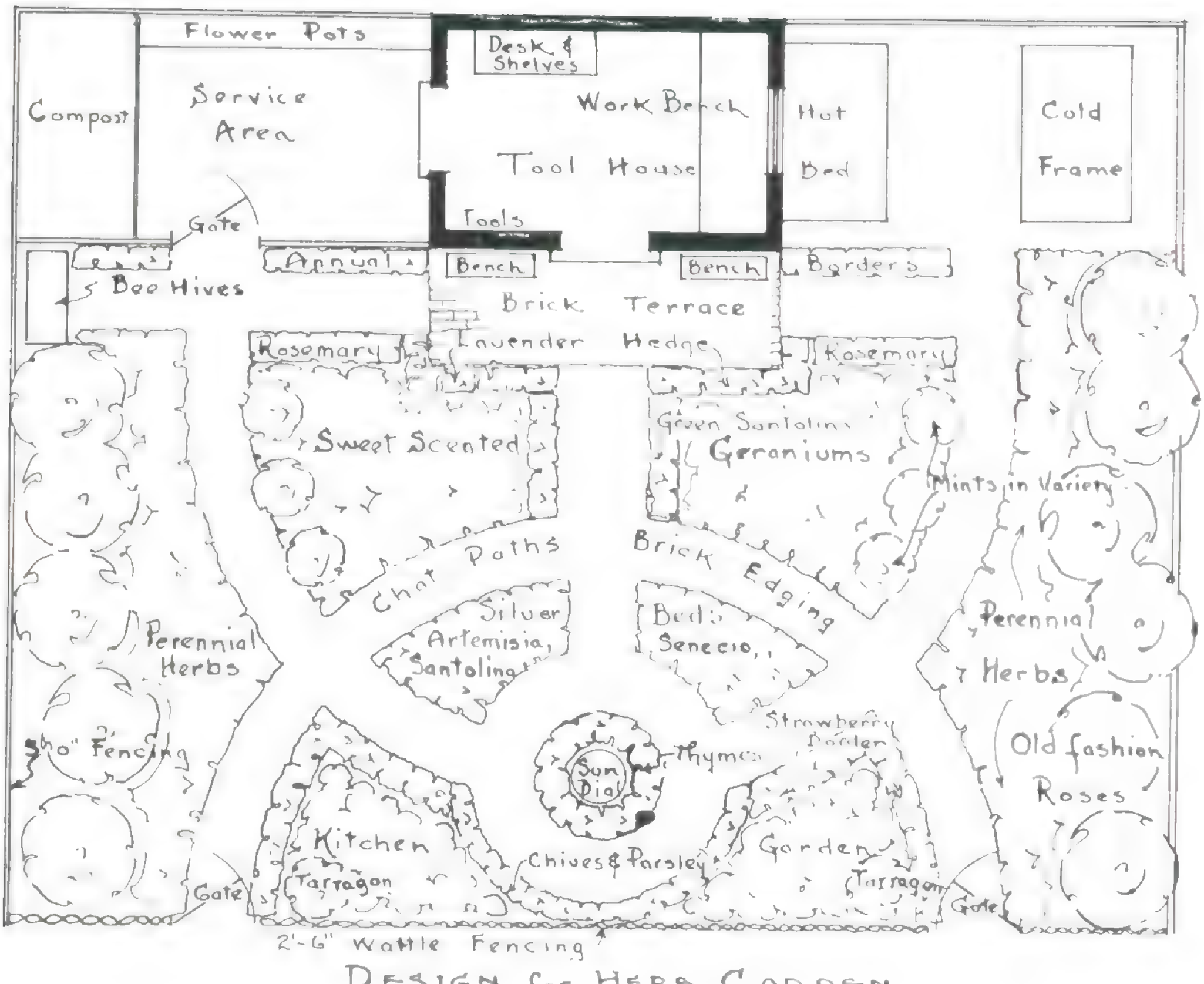
Please: Do not discard a copy of the Bulletin. If you have no further use for yours pass it along to a friend or return it to the Garden. Return postage will be guaranteed.

THE HERB SOCIETY OF AMERICA

It is now nearly twenty years since a group of enthusiastic and able gardeners in the Boston area began to meet with one another to learn about the history, and the growing, and the uses of herbs. Gradually the group grew in number, acquired a formal name, the Herb Society of America, and now has various units throughout the United States. The annual meeting this year is being held in St. Louis from May 23rd to 25th, and this special number of the BULLETIN *has been prepared by the St. Louis Unit, under the direction of its chairman, Miss Edith Mason.*

What is an herb? The word has various uses, and these have varied with the years. The Herb Society, when once it was pressed for a definition, ruled officially that herbs are plants, grown for their savour, for their fragrance, or for their healing qualities. Something of this same idea was incorporated by Mrs. Bratenahl when she prepared the official seal with its motto "For use and for delight."



DESIGN for HERB GARDEN
Scale ¼ = 1'-0"

A NOTE ABOUT THE ILLUSTRATIONS

The garden plan above was drawn by Miss Edith Mason to accompany her discussion of herb gardens. The illustration of a pokeweed with Mr. Sauer's article is from an old drawing by William Bartram. All the rest of the illustrations, including the one on the front cover, are from Lonicerus, one of the books in the Garden's collection of ancient horticultural and botanical writings. This sixteenth-century volume on Natural History was published by the author's father-in-law, Christian Egenolph, an astute business man who pirated the illustrations of more critical herbalists so shamelessly that his books made up in variety what they lacked in accuracy and enjoyed a very wide circulation.

Missouri Botanical Garden Bulletin

Vol. XXXVIII MAY, 1950 No. 5

DESIGNING THE HERB GARDEN

EDITH S. MASON

The basic principles of design are the same for the Herb Garden as other phases of landscape designing. There should be an interesting background, pleasing proportion of the beds, and paths to the unit as a whole, and generally some point of interest, a bench, bird bath, or a bee hive.

The type of garden depends greatly on the owner's interest. If cooking and salad herbs are the chief interest then the practical rectangular garden, with a central path and beds on each side lends itself to the easiest cultivation. Even this simple design can become a most delightful garden with the use of fencing or espalier fruit trees as a background and the beds edged with low hedges or fruit trees.

If one is more interested in the fragrant herbs the garden can be treated more as a perennial border, but because the garden is not dependent on mass effect of colour for its beauty, the fragrant Herb Garden is generally small in size. The design of this little garden may be formal, becoming if desired as intricate in pattern as the famous Knot Gardens of the 17th century. In these gardens not only plants were used but coal, crushed bricks and pebbles to add colour and interest to the design. The garden may be a single winding path depending for its beauty on the variance of the plant material, its difference in colour, texture and growth habits.

Whatever the design there is no pleasure equal to walking in the Herb Garden and smelling the crushed leaves of an aromatic herb under foot or to crush a few such leaves in one's hand.

If you have Heavenly Blue morning-glories, snip a few of them in bud in the evening and place in small vases in your bedrooms where they can be seen on awakening. They open during the night and their clear fresh color helps start the day off right.

The proper way to transplant a tree. From an old wood-cut. Like most of the other illustrations in this number of the BULLETIN, these charming little wood-cuts are reproduced from Lonicerus's treatise on "the Natural History of Plants." Only a real scholar, however, could tell us the exact origin of these pictures which give us such fascinating glimpses of gardening in the 16th century. These particular cuts were borrowed very widely, and in the library of the Missouri Botanical Garden there are at least three old books in which they have been used.

POKEWEED, AN OLD AMERICAN HERB

JONATHAN D. SAUER

Graduate Fellow in the Henry Shaw School of Botany of Washington University at the Missouri Botanical Garden

Over almost the entire eastern half of the United States, poke *(Phytolacca americana* L., formerly often called *P. decandra* L.*)* is a familiar weed. It grows in little scattered colonies around fallen trees in the woods, on shifting stream banks, on the edges of fields and gardens, and in other places where nature or man has recently scarred the mantle of vegetation. Unlike many weeds, poke is no immigrant, but a native of the eastern United States, where it is the solitary representative of a widespread tropical group. Isolated from its close relatives, the species is conspicuous in our native flora by its lush tropical aspect, bright red stems, and heavy clusters of shiny berries.

Such an exotic-looking plant, constantly moving into places where men had cleared, dug, or burned, must have attracted human attention since very

ancient times. A little experimenting with the plants would immediately show that they had several intriguing properties which man could apply to his own purposes. We can guess that the lore and uses of pokeweed, so widespread among recent Indian tribes, originated far back in prehistory. Presumably the early European colonists learned many of the uses of poke, as they did its name, from the Indians. The story of the utilization of the plant cannot be traced very far back with any certainty; even in recent times there are only scattered fragments of information. We will here examine the dim outlines of the story which can be reconstructed from the available records.

POKE IN MEDICINE

The property of poke which has most fascinated man is its dramatic drug effect. Mere handling of the plant sometimes causes skin irritation, but the strongest reactions can be obtained by internal dosage. When raw, all parts of the plant have drug properties, but the root is the most potent. Recently 25 occupants on six floors of a laboratory building in which pokeroot was being milled were unhappily affected by inhaling root particles floating in the air; some were sick in bed for days. Effects on human beings of injections or oral administration of extracts are reported to include sharp pains in many parts of the body, violent headache, general stiffness and soreness, paleness, feeble pulse, feeling of weakness and dizziness, chills, profuse perspiration and salivation, cramps, nausea, coughing, violent vomiting and purging, internal bleeding, dulled vision, terrible feeling of suffocation, drowsiness, stupor, and sometimes death. A plant which produces such satisfactory reactions has naturally not been neglected by primitive or civilized medicine men.

For over 150 years, doctors and chemists have been experimenting with extracts of poke berries, leaves, and roots in an effort to learn their physiological effects and chemical nature. One of the earliest investigations was carried out by Benjamin Shultz, a candidate for the degree of Doctor of Medicine at the University of Pennsylvania in 1795. He administered a series of poke extracts to a "middle-sized dog," which kept the unfortunate animal in a state of violent illness for several weeks, but cured him of a bad case of mange. Many later workers have obtained strong toxic symptoms in laboratory tests with poke extracts on mammals, amphibia, fish, and even other plants. The chemical nature of the compounds present and the reason for their drug effects remain something of a mystery to the present day. The most recent investigators suggest that the plant produces two or more

unidentified compounds active in animal physiology: one which acts as a depressant on the central nervous system, paralyzing heart and respiration, and another which acts as a powerful irritant of the entire digestive tract. Lack of understanding of its drug effect has not discouraged men from using the plant for what ailed them.

Reports of medicinal use of poke by the Indians can be found in some of the earliest discussions of the plant. Shultz had heard that the Cherokees used powdered pokeroot for venereal diseases. About the same time, John Pope saw the Creeks collect green pokeberries, squeeze out the juice, and coagulate it in the sun as medicine for skin diseases. Later, while among the Kansas Indians in the 1830's, J. K. Townsend saw the chiefs smoke a mixture of tobacco and dried poke leaves. Among modern Indians pokeroot preparations are known to be used for skin ailments, bruises, or as a purgative by the Oneidas of Ontario, the Senecas of New York, the Rappahannocks of Virginia, the Cherokees of North Carolina, and the Osage of Oklahoma. The berries are fermented for a wine to cure rheumatism, not only by the Rappahannocks and Cherokees, but also by the Nanticokes of Delaware and the Pamunkey of Virginia.

Non-Indian Americans enthusiastically took over and elaborated Indian ideas of the curative values of poke. In 1650 Parkinson wrote that the colonists of New England and Virginia had made it a familiar purgative. The treatise by Shultz gives a revealing picture of the wonderful cures attributed to the plant by leading medical men of the 18th century. In the 19th century, various infusions and ointments of the root and berries continued to be used as home remedies and prescribed by highly respectable physicians for syphilis, cancer, ulcers, hemorrhoids, diphtheria, tonsillitis, rabies, convulsions, conjunctivitis, tumors, rheumatism, obesity, as a purgative and emetic, for corns, ringworm, scabies, 7-year itch, and skin diseases in general. Veterinarians were equally enthusiastic about its value for animal ailments.

The list of ailments for which poke was invoked gradually dwindled, but some uses have been very persistent. Even after 1900, the U. S. Department of Agriculture was advising farmers that gathering poke berries and roots was a profitable sideline; they could be sold to drug companies at a few cents a pound. The berries and root remained official in the U. S. Pharmacopoeia until 1900. They are still listed in the National Formulary and various dispensatories as an emetic and purgative, but are not often prescribed by physicians today. Occasional use in folk medicine continues, as well as in proprietary reducing compounds sold by various commercial drug companies

An old drawing of the pokeweed by William Bartram. (From Schultz's Dissertion on *Phytolacca decandra*. 1795).

in the United States. There is a small demand for both berries and roots, which are gathered commercially in several midwestern and southeastern states.

POKE AS FOOD

The tender young shoots and leaves of poke, like countless other plants, can be eaten as a cooked vegetable. To be safe they should be boiled thoroughly in a couple of changes of water. Apparently the toxic content of the young shoots is much less than of older stems and roots, which are believed to be dangerous even when cooked. Poke greens are generally regarded as excellent food by all who have tried them. My wife and I sampled them at first with no enthusiasm and some suspicion and were surprised by their mild and delicious taste.

Cooked poke greens are probably quite generally used by the Indians, although there are specific records only for a few groups, such as the Pequots and Mohegans of Connecticut, and the Iroquois of New York. Among both whites and negroes, use of poke greens in the spring is an old and widespread custom. About 1750, Peter Kalm noted that poke greens were common food among the Swedes and English of Pennsylvania. In 1918, W. P. C. Barton found them abundant in the Philadelphia markets. Today this usage is general, particularly among country people, almost any place that the plant grows, all the way from New England to Florida, and west to Michigan and Texas. Marjorie Kinnan Rawlings gives a local Florida recipe for poke greens in her cookbook. Every spring small quantities are sold commercially in St. Louis for a few cents a bunch. Market gardeners regularly bring in greens cut from wild plants or volunteers tolerated along the fringes of their gardens. Dr. E. R. Spencer tells me that around Tulsa, Oklahoma, poke is sometimes sowed for greens, which are not only eaten freshly cooked, but also home-canned.

The juicy berries are an obvious food possibility, but when raw they have an objectionable bitter taste and are probably dangerous if eaten in any quantity. Even the flesh of birds which have fed on pokeberries is reported to be toxic to humans. When cooked, the berries are palatable and apparently harmless, since they have been widely used for pies. C. C. Deam knew an Indiana hotel-keeper who used to gather and can the berries, to be mixed with elderberries in pies.

POKE AS DYE

The berries are also an obvious source of dye. The abundant anthocyanin is easily extracted in water and makes a gaudy red or purple pigment, which can be used for coloring food and beverages or for staining a variety of objects. The color lasts indefinitely if the object stained is not washed. How-

ever, it is unsatisfactory as a textile dye because the color changes and fades on washing. From about 1800 down to the present many persons have tried unsuccessfully to develop a process for fixing the color in textiles.

In 1640, Parkinson noted that the eastern Indians used pokeberries for painting their own skins and dyeing their basketry. The northeastern Indians continued to make much use of pokeberry stains until recent times. Dr. F. G. Speck, Mrs. Eva Butler, and Dr. William N. Fenton found this practice widespread among both the eastern Algonquian peoples and the Iroquois nations. Pokeberries are still used by one Iroquois nation, the Senecas, as body paint and stain for baskets and lacrosse sticks. A detailed account of basket dyeing among another Iroquois group is given in the following extract from some unpublished notes of Melvin R. Gilmore, made available to me by Dr. Fenton and Dr. Volney Jones. These notes record an interview with Albert Schanandoah on the Onandaga Reservation near Syracuse, New York, in 1927.

> "Pokeberry dye was used in coloring decorative designs on the borders of baskets. The color was applied by means of stamps cut out of potatoes. For this process, the pokeberries were dried, finely pulverized, and mixed with a little water in the deeper concavity of a mussel shell. A feather was used to dip into this pigment and spread it evenly on the broad shallow part of the shell. Then the stamp cut from a potato was applied to the spread pigment and the color transferred to the baskets."

Presumably some native tuber was used for the stamp before the introduction of the potato. Gilmore also reported that the Oto and Pawnee of Oklahoma used pokeberries to stain their horses and ornaments.

The pigment has been found less useful by modern Americans than by the Indians. In the 18th century, country people in Pennsylvania used the berries to dye cloth, in spite of the poor results. In colonial times and later, especially during the Civil War, pokeberry juice served both Yankees and Southerners as an ink substitute. The only modern uses reported for the pigment in this country are such trivial things as coloring cake frostings.

The berry pigment has been much more exploited in Europe than here. The poke plant was introduced into the Mediterranean area, probably about 1650, and became highly appreciated for the effectiveness of the berries in improving the color of low-grade wines and liquors. Poke has been extensively cultivated for this purpose, especially in Portugal, Spain, France, and Italy, since the 17th century. Because of its toxic effect, Louis XVI and other 18th century monarchs tried to stop this practice and eradicate the plant, but it had become well established and the use still continues. The occasional poke plants found in the wine area of California may have been brought from the Mediterranean together with the grape, rather than directly from the native home of the species in the eastern states.

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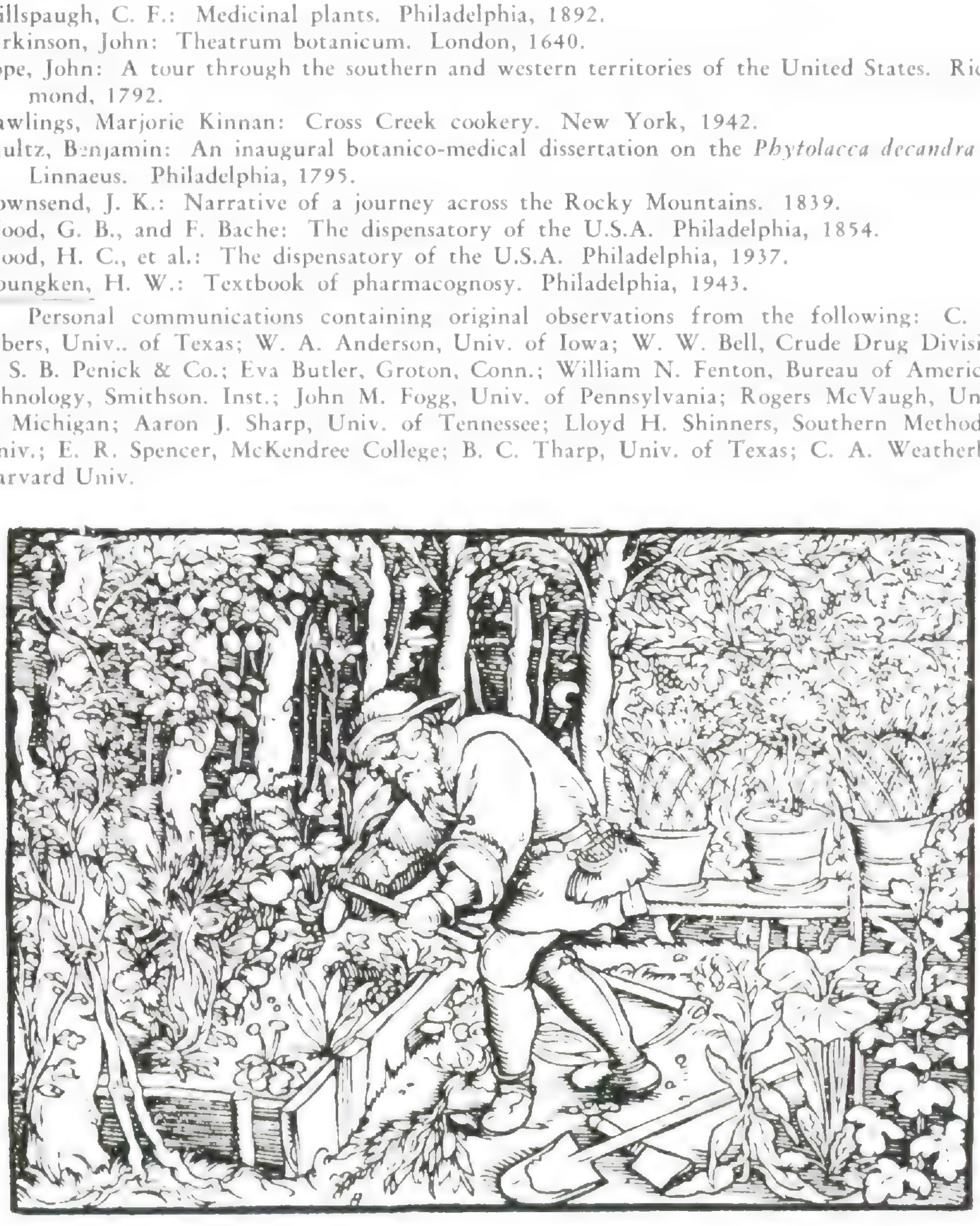


Gardening in the early 16th century

SWEET-SCENTED GERANIUMS

NORA AUSTIN ROEDER

God gave us memories that we may have the fragrant joy of rose or lemon geraniums even when our gardens are faded. Of course, we may be more realistic and grow them in pots on the window sill. Many a visitor leaves the greenhouses with a leaf of sweet-smelling geranium carefully treasured in purse or pocket, to rub between the fingers hours later and recall pleasant memories.

The odor of the bruised leaf gives the clue to the variety. Today there are some 75 distinct varieties, grouped by their pleasant fragrances into six classifications: rose, lemon, fruit, mint, spice, and pungent. In the first group, we find the old-fashioned rose geranium, a favorite of grandmother's day, often used in apple jelly. To this group also belongs Snowflake, a favorite of mine for its foliage of green streaked with white. Outstanding among the lemon geraniums is the tiny *crispum* or finger-bowl geranium. Among the fruit-scented geraniums, we find such lovelies as orange, lime, apple, and gooseberry with its tiny white and green gooseberry-like leaves. The filbert, walnut, and other nut-scented geraniums belong to this group. In the mint group, the handsome peppermint geranium *(Pelargonium tomentosum)* has large downy leaves and a refreshing mint fragrance. The spice-scented varieties include the nutmeg geranium with its round, flat silky leaves. Among the pungent-scented ones, we find such interesting foliage types as the pheasant's foot and crowsfoot, with finely cut foliage resembling the birds' footprints in the snow. Many handsome and strong-growing varieties are to be found in this class.

These sweet geraniums are easy to grow, are adaptable for garden or pot culture. They may be grown in window boxes or in urns or tubs. Tubs planted with sweet geraniums are excellent on either side of the entrance where everyone who enters may pinch a leaf for fragrance. These geraniums not only give you fragrances and interesting foliage texture and color contrasts, but some of them have attractive flowers all summer long. Others are grown for their foliage and fragrance alone.

The attractive fragrant leaves may be used in making nosegays for luncheon guests or to take to the sick in hospitals where they counteract the smells of medicine and where they induce pleasant memories and drowsiness. The nosegays may be made of sweet geranium alone or a frill may be made of the geranium leaves and the center made of flowers. What could be more delightful than a nosegay of heliotrope surrounded by rose geranium? Another pleasing combination might be a nosegay of tiny pink rosebud geraniums at the center, surrounded by heliotrope florets and a frill of sweet geranium leaves. We might remember the blind who cannot enjoy the color and texture of flowers but who can enjoy the pungent scent of the pelargoniums.

Sweet basil, dried in the shade, makes an unusually effective sachet. The odor is spicy, sweet but not too sweet, and garments stored with a basil sachet have a delicate, faintly oriental aroma.

POT-POURRI

MARY E. BAER

Of the many uses made of rose petals, none is more universally appreciated than that of fragrant, colorful pot-pourri. In the Elizabethan days it was used for scenting the linens, and sweet bags were tucked into the chests and drawers. Many of us to-day go back to the pleasant summer ritual of gathering the petals of flowers and aromatic leaves for our own preferred recipes of making pot-pourri.

There are two ways of preserving the flowers: one is the dry, and the other is the moist method. Both require chip-dry petals. They must be gathered on a warm dry day, when freshly opened, without any moisture clinging to them. After gathering, scatter the petals loosely (not one on top of another) on a large window-screen (supported at the ends) in order that an under-current and over-current of air will insure faster drying, always in the shade, preferably in a warm dark attic, or basement. Toss over the petals ever so often, and after a few days, they will be chip-dry. Store in air-tight tins or jars.

The Dry or Colorful Pot-Pourri.—To one gallon of chip-dry blossoms, add one heaping tablespoon of powdered fixative. Orris (powdered) is excellent. To the fixative add one tablespoon mixed powdered spices, generally cloves, allspice, and nutmeg. To this powder mixture, enough essential oil to form a loose lumpy mixture may be added for fragrance. Put this in with the petals, and after several weeks the fragrance will have set.

Essential oils may be purchased from one of the large distributors or from Mary Chess Inc., 654 Madison Ave., New York City. It comes in the following: Rose, Garden Bouquet, and Persian Garden.

Moist Pot-Pourri.—Moist pot-pourri was formerly called by the prettier name of scent jar. The flowers, instead of being bright and colorful and having an essence of scented oils, are more or less pickled. It is made in large earthen-ware crocks. To about two pounds of petals (chip-dry) add one-half pound of coarse salt and a handful of table salt. Place the petals in the crock in one-half inch layers, with a covering of salt over each. Place a lid on top, covered by a weight, and leave it for a week, at the end of which take out the mixture, shake off the loose salt and allow the air to dry out the petals. Return petals to the jar, add spices (about three ounces, powdered or broken bits) to each one pound of petals. Store air-tight for six weeks. At the end of this time, essential oils may be added if desired.

FIXATIVES

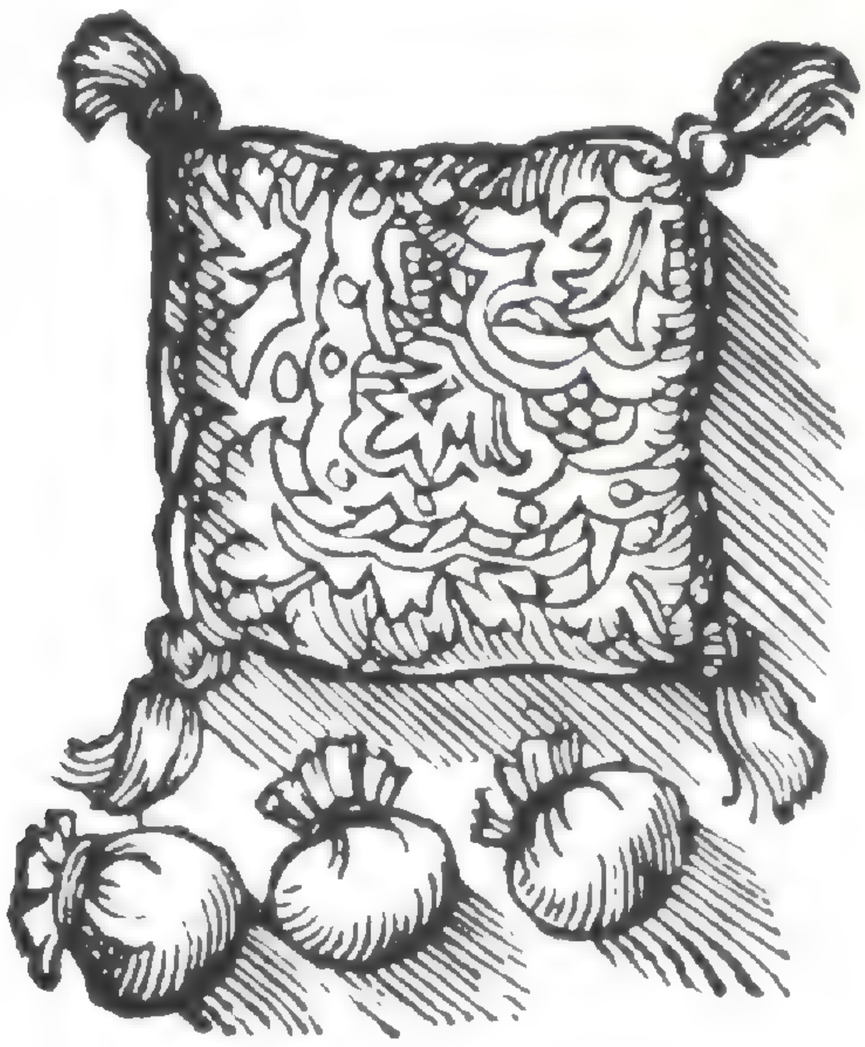
Materials to absorb and retain the fragrance of the essential oils, which are so volatile.—These fall into two groups. The least expensive and most often used are of vegetable nature, the other of animal.

Vegetable Nature.—

1. Orris Root—root of the Florentine Iris, used either powdered or in root form.
2. Calamus—root of the Sweet Flag, *Acorus Calamus.*
3. Benzoin—a hard finely ground resin from the Benzoin Tree *(Styrax Benzoin).*
4. Storax—a balsam, finely ground, obtained from the *Liquidambar orientalis* tree.

Animal Nature.—

1. Castoreum—bitter, brown or orange substance, strong odor, found in the sac of the beaver.
2. Civet—yellow-brown, consistency of butter, musky odor, found in sac of the civet cat.
3. Ambergris—ash-gray, white, yellow or black wax-like substance, found in alimentary canal of sperm whale.
4. Musk—dark reddish-brown, found in sac of musk deer. Obtained under two headings, the tonquin, by far the best and most often used, or the kabardin or Russian.



Sachets from the 16th century.
After Lonicerus.

A pomander of the 16th century. (It was filled with spices and sweet-smelling herbs and carried or worn to fend off dangerous or unpleasant vapours.) From an old herbal.

The following recipes may be of interest to you in making your own rose-jar, or pot-pourri.

Eleanour Sinclair Rohde's Pot-Pourri.—To a large basin of dried sweet-scented rose petals allow a handful of dried lavender flowers, rosemary, thyme, lemon balm, sweet marjoram, southernwood, sweet basil, clove pinks, sweet-briar leaves, wild thyme, garden thyme, hyssop, Philadelphus flowers, orange flowers, mint, sweet-scented geranium leaves, verbena, a few bruised cloves, the dried and powdered rind of a lemon or orange, a teaspoon of allspice, half an ounce of cinnamon and a good pinch of sandalwood.

Gather and dry the flowers and leaves all through the season, adding any others according to one's fancy but keeping the proportions of a basin of rose petals to a large handful of all the other ingredients put together. Store in a jar with a lid, but the jar need not be air-tight.

Dry Pot-Pourri (a delicate soft-scented fragrance).—In equal proportions, take dried petals of roses, clove pinks, lavender, and aromatic leaves of lemon verbena, rosemary, marjoram, sweet basil and a bit of mint. Add a few powdered cloves crushed seeds of anise and coriander, and a little musk and orris root.

Breath of Mary's Garden.—Prepare rose petals according to moist mixture recipe, in crock with salt. Let stand ten days. Remove, shake out salt and allow to dry. Incorporate with following mixture:

Pound in a mortar: ¼ ounce mace, ½ ounce allspice, ½ ounce cloves, ½ ounce cinnamon, 1 tablespoon nutmeg, 1 ounce orris root, ¼ pound lavender flowers.

Mix together: 10 drops essential oil rose geranium, 10 drops orange flower, 10 drops oil melissa.

Fill rose jar with alternate mixture of flower stock and spice mixture, as you proceed add a few drops of the essential oils. Age for four weeks. Refreshing, indefinable, spicy, and unlike any other perfume! You will be delighted with your accomplishments.

Herbalists in their garden and store-room. Note the herbs being put in the chest, the young man helping himself to hair lotion, and the experts conferring in the garden. From an old wood-cut widely used by Lonicerus and others.

A sixteenth century walled garden. From an old wood-cut.

FRENCH TARRAGON

NORA AUSTIN ROEDER

True French tarragon—the epicure's delight—does not set seed and must be grown from cuttings or divisions. Top cuttings about three inches long are cut with a sharp knife and easily rooted in a medium of half sand and half vermiculite. Another method is the lifting of field-grown plants, the dirt shaken from the roots, and the roots cut into small pieces and planted in a flat of half sand and half vermiculite until tiny shoots begin to grow. The young plants, as a result of either method, should then be planted in a good humus-laden soil to which some lime rubble or ground limestone has been added. A "must" for tarragon is that the soil be well drained so that water does not stand around the plant roots.

Young potted tarragon plants will establish themselves in the garden much more quickly than older field-grown plants. Plants in your garden should be taken up and divided every four years to give the plants new vigor.

Incidentally, any tarragon seed you buy will be the Russian variety, stronger and unpleasant in odor and taste.

Workman carrying stakes into a garden. From an old wood-cut.

From the New York unit comes this interesting item contributed by Mrs. Helen Morgenthau Fox. On a plateau about ten miles north of Bennington in Vermont, where people have lived and cultivated their gardens for over 200 years, one August day it was surprising to find a great many herbs growing wild. There was a whole meadow of pot marjoram, clumps of Inula, scattered stalks of agrimony, and oddly enough, *Campanula Rapunculus* not *rapunculoides*, and *Pycnanthemum muticum*. There was also butterfly weed, wild parsnip, and large vines of *Rubus odoratus* and wild grape. Besides the herbs, there were blooming that day Spiraea (meadow sweet), Potentilla, the shrubby form, and Blackeyed Susans. Seeing so many of the escaped herbs it would seem as if a housewife long ago had brought the seeds with her from Europe or from the coast and that the plants had seeded themselves along the roadsides and gone on merrily propagating and increasing as the years went by.

corum TOMVS Secundus. 35

FRAGARIA.

Erdtbeerkraut.

¶ Fragariam Pentaphylli ſpeciem, uide in prio= re item Tomo, in deſcriptione Quinquefolij, fo= lio. 231. & ſequen. Rurſus infra huius Tomi Ap pendice, quod planius Index eiuſdem indicabit.

Wood-cut of the strawberry plant from Brunfels' Herbal, 1532.

A ROSE FOR THE HERB GARDEN

EDGAR ANDERSON

No rose is more in place in the herb garden than *Rosa alba*, the pale pink or white rose of the Middle Ages and the Renaissance. One sees it in the background of many Florentine paintings, frequently trained arbor-wise into a sheltering semi-circle for little gardens of simples. It is so old and plain that it has long since vanished from all but the most *recherché* of catalogues yet it is such a sturdy dooryard rose that one frequently sights husky specimens blooming freely in farmyards or even in old gardens now in the tenement district. Its petals, if carefully dried, make the daintiest of sachets, and the canes are so strong one can even train it as a standard.

Spiced tomatoes—delicate and distinctive. One small can of tomatoes, one-half teaspoon of mace. Salt and pepper to taste. Heat and serve.

Grow your own salads while the snow is on the ground. Winter Cress, sprouted on a wet sponge, or in a tray with damp cheese-cloth, will be ready to start using in a week and can be grown in a kitchen window if it is kept damp. It can be used any time after it has greened up. It is delicious in little sandwiches, or added to lettuce and other greens for a more distinctive tossed salad.

How to use wild cherries, an old family recipe:

Hillside Cherry Bounce.—One pint of wild cherries dropped into a gallon of good whiskey or brandy. Steep one month, stirring occasionally, then strain juice. For every gallon of juice take 5 lbs. white sugar and 1 quart of water. Boil and skim. Cook until almost candy, stir and add to whiskey while hot. Let stand six weeks before using, shaking frequently.

For a late summer reception or tea there is nothing to compare with the brilliant fruits of *Rosa rugosa*. These are larger and jucier than most other rose-hips. Gather as many as you can, scoop out the seeds, and fill them with cream-cheese or cottage cheese to which a little chopped rosemary has been added. They are as beautiful as they are delicious. If you have lemon thyme, it makes an attractive green background for the orange-red of the rose-hips, or serve as a salad with your favorite French dressing.

MY HERB GARDEN

ALICE HUSCH

During the repeated days of heavy rains last fall, when I stood on the open porch high above the garden the sweet scents rose above the rain and mingled with it. And that day I had a sudden inspiration. The herb garden is just outside of my small greenhouse. How nice it would be if I could glass over the entire garden and keep my herbs growing all winter! Of course I couldn't, but I could easily glass over one of the parsley beds and that way have fresh green parsley for my kitchen during the cold dark months ahead. We did that very thing. We placed wooden sides all around one of the isolated beds and covered it with window glass. By watering only when necessary and airing as often as possible, we had parsley that was a joy all winter—beautiful to look at, delicious to taste, and wonderful to smell.

The double yellow buttercup.
From Lonicerus.

THE MISSOURI BOTANICAL GARDEN

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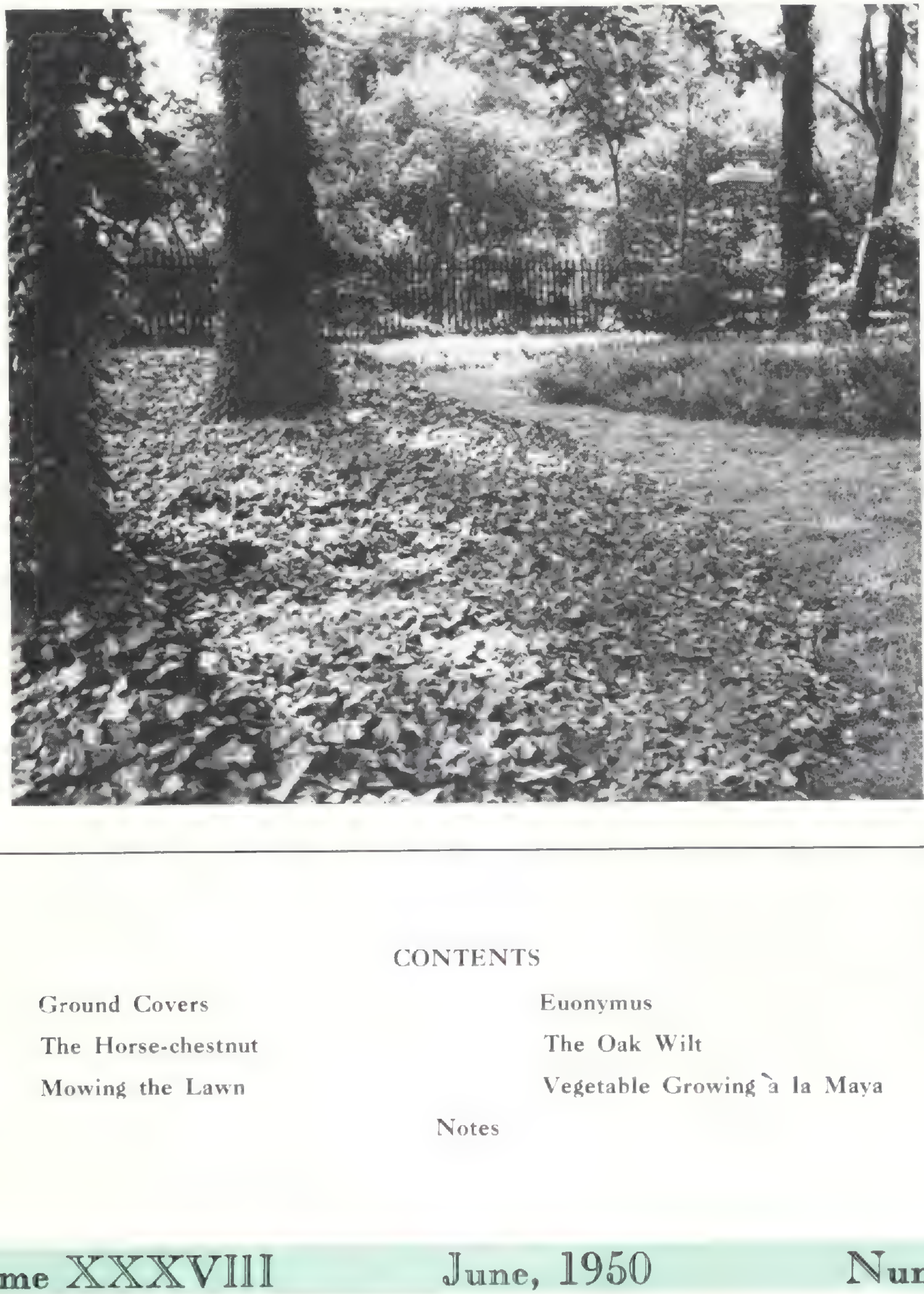
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 40,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until 7:00 p. m.; Sundays, 10:00 a. m. until 7:00 p. m. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah bus line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

MISSOURI BOTANICAL GARDEN BULLETIN



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Missouri Botanical Garden Bulletin

Vol. XXXVIII JUNE, 1950 No. 6

DRESS UP YOUR GARDEN WITH GROUND COVERS

PAUL A. KOHL

Shrub borders look neat and require less upkeep when a living mulch hides the bare soil. Almost every garden has an area where it is difficult to grow flowering plants or even maintain a lawn because of insufficient light or the proximity of buildings and fences. What can be done to improve the appearance of these areas? The answer is to use ground covers. Now what are the qualifications of a good ground-cover plant? Hardiness is one; a good year-round appearance is another; plants that spread rapidly are most desirable; and freedom from disease and insect troubles must also be considered.

One objection to the use of ground covers is that they are expensive when many plants are needed. That is true, but it is possible to reduce the cost when a definite propagating and planting program is maintained. It takes

Junipers and English Ivy

English Ivy in Mausoleum grounds at Garden

time to establish a tight cover but with close planting this can be accomplished by the second year, and thereafter maintenance is reduced to the few operations of keeping the edges trimmed, feeding once a year, watering in drought periods and pulling the few weeds as they appear. One could compile a lengthy list of ground-cover plants, but when each is checked for the

four basic qualities of being evergreen, hardy, free from insects and diseases, and having the ability to spread, the list shrinks to just four plants: English Ivy, Trailing Vinca, *Euonymus fortunei* var. *colorata*, and *Pachysandra* sp.

English Ivy *(Hedera helix)* is one of the very best ground-cover plants. A number of strains are available, var. *baltica* being a good one. In the Garden BULLETIN for March, 1945, mention was made of the two Balkan ivies, "Bulgaria" and "Rumania", for St. Louis gardens. These are exceptionally desirable strains.

Another excellent ground cover is *Vinca minor*, commonly called Running Myrtle or periwinkle. The variety "Bowles" has larger leaves and larger, darker blue flowers than the common variety.

English Ivy and *Berberis julianae*

The third spreading plant is *Euonymus fortunei* var. *colorata*, the Purple-leaf Wintercreeper Euonymus. There are other varieties of Euonymus which can be used, but var. *colorata* is preferred because of its autumn coloring. If Euonymus scale is prevalent in a locality and cannot be successfully controlled by spraying, it would be better not to use this ground cover and limit the choice of plants to either English Ivy, *Vinca minor*, or Pachysandra.

A plant that has been much used in gardens, particularly in shady places, is Pachysandra. It is a fine ground cover and the only reasons for not using it more often is that it takes longer to form a thick mat and that one hesitates to walk on it because of its upright growth.

Pachysandra terminalis in Mausoleum grounds at Garden

Before one plants a ground cover, questions come to mind as to the number of plants required, the best time for planting, amount of care needed until the plants are established, and the cost. The price of Pachysandra and Vinca will average about twenty-five cents a plant, and Euonymus and ivy about sixty cents. The thing to do to cut costs is to grow a few dozen to several hundred plants and later extend the planting by means of cuttings

and divisions. A foot apart each way is a good average spacing distance for any of the plants mentioned.

Cuttings may be made in early spring before growth commences and again in early July when the new sprouts are firm. They are not difficult to make; just cut strands of Euonymus, ivy or Vinca into pieces three to four inches long, then dip the cuttings in a hormone powder and insert them in

Euonymus fortunei as a ground cover in Mausoleum grounds

rows in boxes of sand. Shielded from the sun, watered once a day or just enough to keep the sand damp, the cuttings will be rooted in about four weeks. If time permits, they may be potted into 2½-inch pots and kept in a cold-frame until needed, or they may be left in the boxes of sand for a month or more, and then planted directly where they are to grow providing the soil is damp or it is possible to water. Except that Pachysandra cuttings are made from the tips of the shoots, they are treated in the same manner as the other cuttings. Euonymus, ivy, and Vinca produce roots at many joints as they spread. These runners can be lifted when the soil is moist, cut into pieces, and planted. This may be done in early spring and again in September and October.

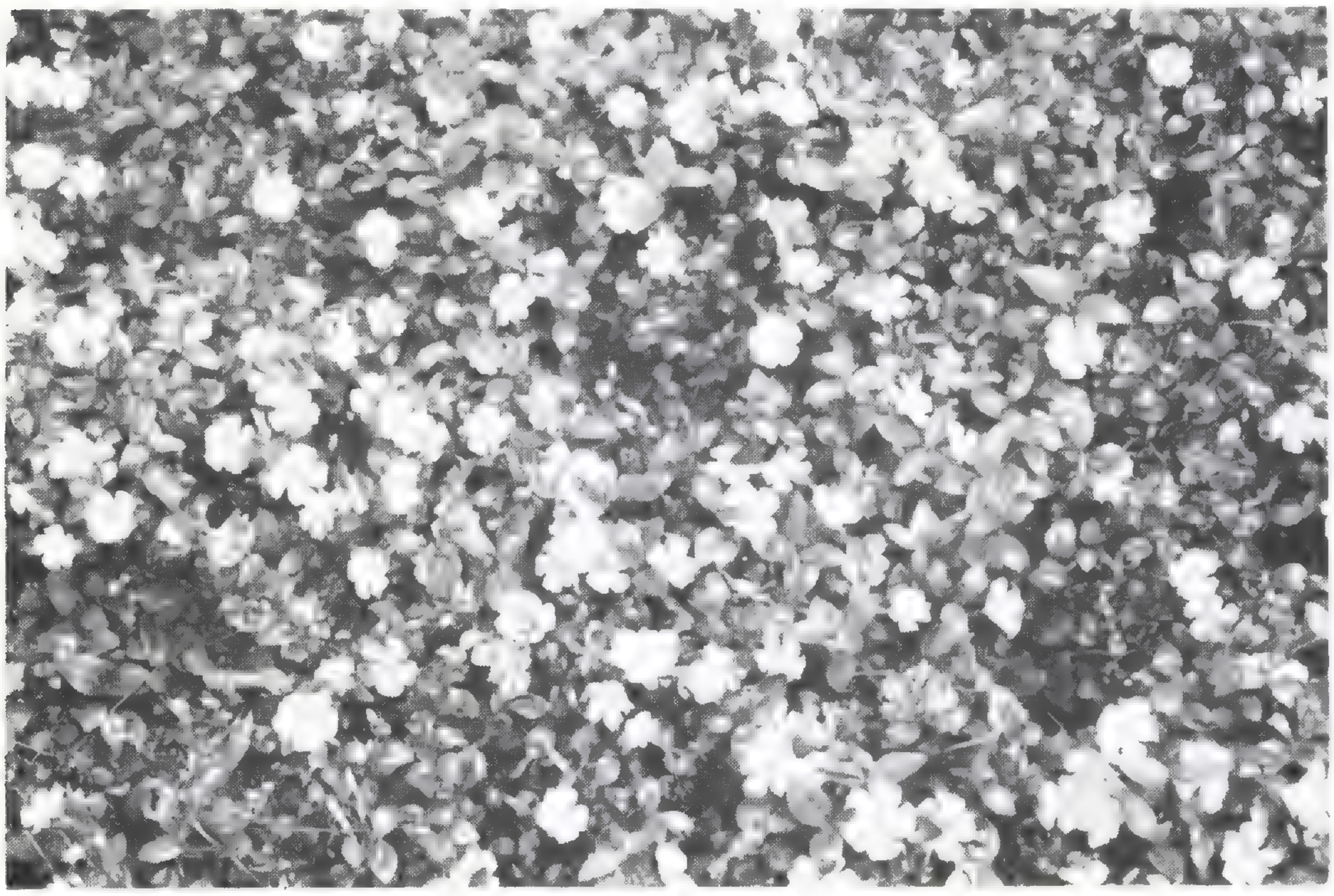
Weeds will be troublesome until a ground cover has grown together, but the weed problem can be reduced considerably if plants are set out in the autumn and lightly mulched with leaves or straw in November to protect them the first winter. Another advantage of planting in the autumn is that

A lowered street level left these trees exposed

English Ivy improved the appearance of one group

they will cover an area faster the following year than those planted in the spring. Never mulch ground-cover plants with a thick layer of leaves, for if light and air are excluded, the plants will die.

After a ground-cover planting has filled in, it needs very little attention. Every year or two it is a good practice to broadcast an organic or chemical fertilizer over the planting. To prevent any "burning", flush the fertilizer from the leaves with the hose. English Ivy is free from faults except that some leaves are browned by the winter's sun in zero weather, when there is no snow. Vinca is equally as good. Occasionally a few strands turn brown, but this condition seems to be associated with heat and dry weather. Euony-



Vinca minor var. "Bowles"

mus becomes infested with scale in some places, and to control it the planting must be thoroughly sprayed in early spring with an oil spray, such as Volck. A second spraying in June, when the temperature is below 80°, is advisable, and nicotine should be added to the "Volck." Seldom is it necessary to water ground covers unless a drought period lasts so long that the plants show signs of wilting.

The benefits of ground covers are many. How much more pleasing is a shrub planting or shaded area with a neat, even covering of ivy or Vinca compared to bare or weedy soil! These two plants remain a rich, deep green throughout the year and then in spring the fresh leaves gradually hide the old ones of the previous years. Ivy generally does not flower, but Vinca is stud-

ded with myriads of blue flowers at the time the daffodils bloom. In October, *Euonymus fortunei colorata* changes from green to a warm, red-purple tone which is so much a part of the autumn scene. Pachysandra remains green all the year, and though it does have white flowers they are too small to be noticed.

THE HORSE-CHESTNUT AS AN ORNAMENTAL TREE

ROBERT W. SCHERY

Although the stately European horse-chestnut, *Aesculus hippocastanum*, has been widely planted throughout the world as an ornamental shade and park tree, it remains comparatively little used in the St. Louis area. Perhaps this neglect results from unfamiliarity with the species, for certainly few arborescents, native or exotic, can equal it as a specimen tree.

One of the outstanding features of *A. hippocastanum* is its compact, symmetrical growth. Both in and out of leaf it gives the impression of having been meticulously pruned to an almost perfectly ovoid outline. The illustrations on page 107 show such specimens at the Garden, with the compact rounded crown Rehder associates with the *umbraculifera* variety. Other types include those with a more narrowly pyramidal shape, those with pendulous branches, and a number of named varieties based on leaflet shape or color and upon doubleness of flowers.

A second striking feature of the European horse-chestnut is its large, beautiful flower panicle, in good years borne terminally upon almost every branch. I can recall no year when *A. hippocastanum* has flowered to better advantage than 1950 (page 108). As is characteristic of most species of the genus Aesculus (buckeyes), the flower cluster is carried through the winter already partially formed in the large, resinous terminal buds. Soon after the buds open, late April in St. Louis, the flower cluster rapidly expands to form a colorful spray often ten inches tall. When the flowers first open they are white tinged with yellow towards the base of the petals, but as they mature the yellowish blotches become pink or red. These delicately tinted flowers bearing graceful arching stamens provide an attractive display either viewed close-up or from a distance.

The leaves of the European horse-chestnut, like those of our native buckeyes, are distinctive in being palmately compound, that is, the leaflets are arranged from a central point like the fingers on the hand. The leaflets are seven in number, the larger ones to the front, all of them delicately toothed along the edges. These large leaves, arising from four sides of the coarse branch, effectively catch the sunlight, so the tree provides a very deep shade. Such shade may hinder lawn grasses or ground covers, but is very welcome

Horse-chestnut (*Aesculus hippocastanum*)

Bird's-eye view of horse-chestnut

in the heat of St. Louis during July or August. The large, coarse and rather striking leaves make this tree an eye-catcher, and therefore more suitable as a specimen tree than for background or grouping. Lower branches are seldom shaded out but persist almost indefinitely, so that there is little natural pruning and scarcely any need for manual pruning. In fact, the tendency for *A. hippocastanum* to maintain its low, sweeping branches commonly prevents walking beneath the tree without some of its limbs being removed. The species is moderately slow-growing, and ordinarily suitable for the small place. Yet venerable trees are reported to attain heights of 100 feet and trunk diameters of nearly 5 feet.

The attractions of the horse-chestnut are not limited to flower and foliage. Few are the boys who aren't fascinated by the large, shiny, maroon seeds that appear 1–3 in the spiny husks in autumn—or few the men of the Midwest to whom the sight of buckeyes does not evoke nostalgic memories. Even the spiny husks offer interest, before the first autumn tang brings their rupture and discharge of the seeds. Buckeyes are apparently favorites, too, with the squirrels, for young plants seem to spring up everywhere from seeding by this familiar rodent. In Great Britain the deer in the parks are reported to relish the horse-chestnut seeds.

Flowering branch of *Aesculus hippocastanum*

Aesculus hippocastanum has been used as a parent in crosses with *A. pavia*, to produce another attractive and widely planted tree, × *A. carnea*. This hybrid has flesh-colored flowers and the fruit husks are less spiny than those of *A. hippocastanum*. As with *A. hippocastanum*, several horticultural varieties have been selected.

Reportedly, the European horse-chestnut first reached western Europe in 1576, when seeds were sent from Constantinople to the Austrian botanist Clusius. The species spread almost at once to France and England, where it became well known and widely planted in the seventeenth century. Yet for two centuries its exact place of origin remained a mystery, being regarded as most probably India, but even North America. During the late nineteenth century its original home was established by the finding of undoubtedly wild trees in the Balkan area—in the mountains of Albania and northern Greece. Thus we can thank an unknown benefactor of some four centuries past for horticultural introduction of a tree that has much to recommend it for modern planting in the St. Louis area.

EUONYMUS

A. P. BEILMANN

Probably no group of ornamentals is so widely used as the winterberries of the genus Euonymus[1]. Included are plants suitable only as ground covers (see p. 103), some mimicing climbers and able to grow up a wall, and still others which are trees. The plants in this genus can be grown as ornamentals either for their persistent foliage or for their fruits. The fruits are strongly colored, pink, orange, red, and brown, becoming conspicuous as the leaves fall. The evergreen or semi-evergreen types are more attractive, but they usually produce few fruits. A greater number of the species, however, are small deciduous trees noted for their brilliantly colored fruit. The trees range in size from the modest native Wahoo *(E. atropurpurea)* to the Winterberry Euonymus *(E. bungeana)*, which may reach a height of 25 feet with a trunk diameter of 16 inches. The fruits of the Euonymus being much sought after by birds, plants of this genus are good for naturalizing in fence-rows and wind-breaks.

Although there are no true climbers in the genus, the evergreen varieties of *E. fortunei* do manage to reach a height of 25 feet while clinging to buildings and tree trunks with special rootlets. As climbers they are very effective but require some shearing to keep them close to a wall; otherwise they are in danger of destruction during an ice storm. There are a number of varieties of this species of which *colorata*, *radicans*, *carrierei*, and *vegeta* are more frequently seen. These are also the hardiest of all the winter

[1] Alternately spelled *Evonymus*.

Euonymus alata

creepers. The last two produce many fruits and will climb if supported, while the first two are generally sterile but are better climbers. *Euonymus fortunei* also includes two good ground covers (vars. *minima* and *colorata*), the Baby and Purpleleaf Wintercreepers. All these varieties can stand full sun but do about as well in partial shade. The creeping and climbing types require a good soil to make the necessary rapid growth.

All the shrubby evergreen types are outstanding. The Spreading Euonymus (*E. kiautschovica*, or *E. patens* of some authors)is one of the best. It is almost completely evergreen, holding its foliage until a late spring frost. It flowers abundantly in August but the fruits are not very ornamental. It can be used as a formal hedge, a sheared specimen plant, or it might be left to grow unattended in the shrub border. The Japanese Euonymus *(E. japonica)* is only partially hardy. It may be injured severely in some winters, but it could be grown if pruned to the ground each year.

Among the tree forms is the Winterberry *(E. bungeana)*, which forms a wide spreading tree of dense foliage and is noted for its heavy production of fruit. The European Burning Bush *(E. europaea)* is a much smaller tree but equally spectacular in fruit and is a very valuable ornamental for the small home grounds or in the larger border plantings. The most interesting

Euonymus bungeana

form for stunning autumn coloration is the Yeddo Euonymus *(E. yedoensis)*. This is hardly more than a shrub with the single tree trunk reaching no more than twelve feet. The leaves usually turn red on the upper surface and a brilliant yellow on the lower for a short period before they are shed. The Winged Euonymus *(E. alata)* is a good ornamental of shrub-like habit with leaves turning a brilliant crimson in the autumn. In winter the broadly winged branches are very evident. This species can be used in a formal hedge or it might be left alone and grown as a specimen with the lowermost branches touching the ground. The European Burning Bush *(E. europaea)* has a number of varieties including one with purple leaves which can be mistaken for our native Wahoo *(E. atropurpurea)*.

Quite a number of other varieties and species might be added to this list. Most of them, except for the variegated types, are not often encountered in private gardens. There are small-leaved forms of the Japanese and variegated leaf or golden- and silver-margined forms of some other species. Only two, however, merit mention: the Broadleaved Burning Bush *(E. latifolia)* with great shiny leaves and bright red-orange and white fruits; and *E. przewalskii* which has dark purple flowers remaining open for a long time, but with

Euonymus kiautschovica

more modestly colored pink and orange fruits. Almost any of these have their use in the garden. The genus is closely related to the Bittersweet *(Celastrus)*, and the fruits are very similar except for the unusual color combinations.

A SECOND LOOK AT AN UNMOWED LAWN

ROBERT W. SCHERY

Little more than two years ago a Garden BULLETIN[1] contained some notes on the advantages—and, yes, disadvantages—of not mowing the home lawn. Another season of the same experiment (1948), followed by one of mowing at 2½ inches in height (1949), presented few conclusions[2] not reported in the above-mentioned article, but it may interest readers to know the present status of the members of that miniature community of plant species, the lawn, after a second and third season of such unorthodox handling. Here is a report on these members:

[1] The Lawn—To Mow or Not to Mow. Mo. Bot. Gard. Bull. March, 1948.

[2] In the previous article we perhaps underestimated the appeal to neighbors. One of the male tribe was heard wistfully to wonder if it wouldn't be wise to give his lawn the unmowed treatment—in the fond (but futile) hope that perhaps his superior officer in the household might agree.

BLUE-GRASS *(Poa pratensis)*, Pillar of Society.—Prospering, without any water other than rainfall and with only modest winter fertilizing. As is well known, blue-grass is active during autumn and spring, takes a "vacation" during hot summer, lying browned and semi-dormant. Lack of mowing favored blue-grass over the later-growing crab-grass; by the time the annual crab-grass gets really going in the hot weather of late May blue-grass is tall enough and dense enough to smother most of it. Yet robust clumps of blue-grass also smothered adjoining small plants of the the same species, so that the lawn area developed a clumped or mounded appearance in autumn and early spring until luxuriant growth once again became manifest.

CRAB-GRASS *(Digitaria* spp.*)*, Member Out of Favor.—Not doing at all well, simply because blue-grass usurped his space early and completely. The few plants of crab-grass that did get through the mat of unmowed blue-grass were yanked by hand before seeding. Crab-grass, being an annual, no seeds means no plants. Two years of non-mowing, with a good blue-grass stand present, practically eliminated crab-grass, and a third year of high mowing has seen no significant recurrence.

CHICKWEED *(Stellaria media)*, No. 1 Villain, but losing some ground.—Chickweed grows too early in spring to be smothered by blue-grass, and has set seed before the lawn is even luxuriant. In 1950 chickweed was in flower as early as February 20. Moreover, occasional heavy treatment with 2-4-D has been only mildly inhibitive to chickweed. Other users, perhaps purchasing better chemical forms or better brands of 2-4-D, report more luck, but not perfect control. The only certain solution seems to be hand-pulling of chickweed before even outdoor weather tempts us into enjoying our spring fever on the turf.

DANDELION *(Taraxacum* sp.*)* and PLANTAIN *(Plantago* spp.*)*, Ex-villains.—These hardy fellows have been easy victims of 2-4-D, and give blue-grass little or no competition.

CLOVER *(Trifolium repens)*, The Steady Worker.—Clover has about held its own in spite of occasional 2-4-D and lack of mowing. We like clover in the lawn, but for those who don't perhaps 2-4-D persistently applied would be the answer. The seasonal ups-and-downs in the "life of white clover" roughly parallel those of its Old World compatriot, blue-grass.

MISCELLANEOUS GRASSES (rye, *Lolium* spp.; redtop, *Agrostis alba;* fox-tail, *Setaria* sp.; targrass, *Triodia flava;* orchard-grass, *Dactylis glomerata;* etc.), The Hangers-on.—Most of these grasses come a slight bit later than blue-grass, and are somewhat handicapped by the unmowed blue-grass. Yet remnants still remain in isolated spots midst blue-grass turf and there offer a disruptive pattern to the lawn.

March 30, 1948—Lawn mowed to 2½ inches

DISCUSSION

After two years of not mowing, my lawn-mower was remade to cut at 2½ inches and used weekly. In two years once abundant crab-grass had been reduced to the point of elimination, but the lawn was still mowed high to keep a heavy blue-grass carpet and thereby prevent a crab-grass comeback. However, no mowing at all makes blue-grass overly clumpy, and even a succeeding year of lawn community life at a somewhat lower level, namely 2½ inches, has failed to fill in intermittent bare spaces.

While on the subject of the lawn community one might be reminded that the giant members, the trees, may have their say-so about community membership. Have you ever noticed in autumn and spring, when blue-grass spruces to his best but crab-grass is literally out in the cold, that the greenest (and sometimes the only green) spots are near trees, especially to the north of them where their shadow falls much of the day during the heat of summer? Crab-grass can't stand such a shielding from the glory of the sun, while blue-grass apparently is very appreciative of the lowered soil temperatures afforded by light shade. Hence high-crowned trees that allow ample light but not full sun become an ally of any one who seeks to establish Mr. Blue-grass as the preeminent member of St. Louis lawn society—at least in competition with crab-grass.

June is the month of the fragrant Linden or Basswood, species of which are common in the northern hardwood forests of both Eurasia and North America. An unusual feature is the elongate leaf-like bract from which the flower cluster arises. At first glance it might be taken for part of the foliage, although its slender shape is quite different from that of the leaves.

THE OAK WILT

A. P. BEILMANN

Oak Wilt, a new threat to our shade and forest trees, coming on the heels of two serious diseases of our elms, has aroused far more interest and concern than is usually manifested by such arboricultural and forestry problems. The disease is caused by a fungus *(Chalara quercina)* which may attack and kill all species of oaks. The areas most seriously troubled are in southern Minnesota and Wisconsin and northeastern Iowa. However, the Oak Wilt is now becoming more widespread, and it has been known from St. Louis County for about seven years. The Red Oaks seem to be especially susceptible, often dying in the course of one summer. The White Oaks are far more resistant and several years may elapse before death occurs.

The fungus is believed to overwinter in the White Oaks, but no carrier has been discovered which would account for the slow spread in some localities and the many miles intervening between affected areas. Squirrels have been blamed for spreading the fungus spores, and certainly root grafting, common enough in forests, would account for a local re-infection. Ordinarily, the pathologist suspects that it is an insect that carries the disease from tree to tree and establishing new infections miles away, but so far no insect vectors have been discovered for Oak Wilt.

In many respects Oak Wilt resembles Dutch Elm Disease. Both fungi produce many small spores which can spread through the tree very rapidly, and both produce toxins which cause very rapid wilting. At least the fungus in pure culture produces a material which causes the symptoms of the disease.

Efforts to control Oak Wilt have so far been unsuccessful. The only measure that has checked local spread has been the quick removal of all infected trees. Pruning wilted branches may prove of some value in White Oaks, since several years may elapse before they die. However, even the most drastic pruning cannot check the spread of the toxins in the Red Oaks, and they often die in a few weeks. The chemical treatment of the soil, such as has been worked out for Dutch Elm Disease, may possibly prove of some value for important shade-tree oaks. The oaks, though, are unlike the elms in their acceptance of trunk injections and differ quite as much in their absorption and distribution of soil chemicals.

At the moment we can do little more than remove infected trees as quickly as possible although this will not necessarily stop the disease. A neighboring White or Bur Oak may harbor the fungus and re-infection may occur during the following year. There is some comfort in the thought that only one of the several serious threats to our forests and shade trees has destroyed all trees of a certain species. While the Chestnut Blight has caused the death of nearly all American Chestnuts, neither the Dutch Elm Disease

nor Phloem Necrosis has succeeded in destroying all the elms. It is quite possible that this new disease will not kill all oaks, and it may prove to be an arboricultural rather than a forest problem. This new threat again emphasizes the need to grow many species so that a single disease cannot kill all the trees on our streets and around our homes.

À LA MAYA

ROBERT W. SCHERY

Have recent years seen a cycle completed, and the radical fringe of the agricultural world taking its cue from a race whose glory is dead some score of centuries? Have some, in effect, turned to a mechanized *milpa*[1] agriculture for the small place (just as some will tolerate no "chemical" fertilizer in the garden)? Faulkner, of "Plowman's Folly" fame, says a system of this design works and is most wise. Authors are legion who advocate growing, though not planting, through mulch. And my vegetable patch, ordinarily lost in a wilderness of weeds, was once planted by *milpa* of a sort.

The whole "experiment" started because of an old strawberry bed. The soon-to-be dry and hot season of 1946 had, unfortunately, been chosen as a time to renovate the bed. The soil was moderately fertilized and thoroughly turned-over, but the strawberry settings didn't get by Old Man July. To try to control weeds in the bed thinly populated with strawberries, a mulch of hay from an adjacent mowed meadow was spread over the bare soil space and between the few remaining strawberry plants. This mulch, blended as the season progressed with a scattering of weeds, remained *in situ* all the late summer and autumn of '47, and through the winter of '47-'48.

The scene shifts to spring of 1948. With all the enthusiasm that spring engenders, we had ordered seeds and planted the various vegetables amenable to starting under glass. But fine early spring weather prior to customary outdoor seeding dates suddenly changed to rain, cold, and gloom about the time to put in early seeds and plantlets. Garden soils, except in most favorable situations, could not be worked. Onions, cauliflower, and other vegetables started under glass were fast becoming oversize and flat-bound. No outdoor seed-bed of the traditional pulverized soil type could be readied for peas, spinach, chard and other early crops.

[1] Readers will recall that *milpa* was the Mayan system of agriculture in Central America and southern Mexico during the first ten or twelve centuries A.D. It consisted of clearing land (in the Mayan empire almost entirely tropical forest) through killing as much of the vegetation as was possible with the primitive tools available, and burning the area over in the dry season. Holes were poked into the soil with *milpa* sticks, and a few seeds inserted. Beans and maize were typically grown until infestation with grasses and weeds prevented further growth. The impenetrable herbaceous cover, along with exhaustion of the soil, made necessary abandonment of cultivated ground and clearing of new after only a few years.

A tour of desperation led to last-year's strawberry bed. There one would walk over the springy grass (and some weed) mulch. And there an exploratory prod beneath the heavy mulch revealed a cool, crumbly soil amenable to *milpa* planting. Evidently the mulch had sponged the heavy rains, encouraged the soil organisms, and supplied a chaff of organic debris atop the topsoil which was physically helpful even though a grass mulch shows little decay in eight months.

The hint was sufficient. A *milpa* stick was fashioned. Holes were jabbed and pea seeds inserted (a corn seeder would have saved labor), and later beans, greens and onion seedlings were planted by the same system. The *milpa* holes were sealed by a blow from the heel of the hand as the digging stick was removed. For this small garden planting was completed in a few hours, directly through the mulch, or with seedlings by dibber planting where a row in the mulch had been raked open. Certainly no more than half the time was consumed that would have been needed for the traditional spading, raking, pulverizing, seeding, tamping, and perhaps watering, usually considered indispensable to the setting-out of the spring garden. Faulkner (author of "Plowman's Folly"), you may remember, found the same to be true on a larger scale in his Ohio try at planting on this principle, when soils were too wet for traditional seed-bed preparation. His "*milpa stick*," as I recall, was a large spiked roller, tractor drawn.

The "proof of the pudding" were the results achieved in my garden. Peas, greens and onions came up well and thrived with little weed competition. Beans were less successful, probably because of the cold rather than because of the system practiced. Certainly greens were to be had from my mulched plot long before any could be grown in the usual manner. The quantity of pea plants grown proportional to number of seeds planted was perhaps poor, but this is likely attributable to the imperfect "*milpa stick*" (nothing more than a marking dowel found near the garden) giving uneven and uncertain depth at seed planting, an imperfection easily remedied by placing a collar the desired distance above the point of the stick.

All in all, the system this year appeared successful, taking advantage, of course, of the fortuitous presence of the mulch. It did permit outdoor planting and seeding when such was scarcely feasible by any other method. It seemed to carry to maturity as high a proportion of plants as would have a cultivated plot, and certainly much sooner with early varieties than would have been possible the '48 season with cultivation (as already mentioned, a vital consideration in the St. Louis area). Yet where weeds are a great problem their control might be more difficult without tillage, and adequate mulch material might not be available. Aside from this, there seems no reason why *mulch-milpa* might not work for the small garden almost any year.

NOTES

The second number of Vol. 37 of the ANNALS OF THE MISSOURI BOTANICAL GARDEN, consisting of the second fascicle of Part V of Woodson's and Schery's "Flora of Panama," was issued during the month.

The delegates of the International Association of Official Seed Analysts, touring this country as guests of the American Seed Trade Association, visited St. Louis, May 17–19. On May 18 they visited the Garden and were conducted through the grounds and buildings by Dr. Anderson and Mr. Pring. Those attending were from England, Ireland, Sweden, Denmark, Germany, Netherlands, France, Switzerland, Italy, Spain, Yugoslavia, Egypt, Philippines.

Students in the Henry Shaw School of Botany who received their doctor's degree at the commencement at Washington University June 6, were: Alfred G. Etter, Richard W. Holm, Ko Ko Lay, Sergius H. Mamay, Frank L. Mercer, Jonathan D. Sauer, Carl B. Umanzio. Those receiving the Master of Arts degree were: Hugh H. Iltis, Marilyn Amy Gage, George Freytag, Sidney D. Rodenberg, and Robert A. Dietz.

The members of the Herb Society of America, which convened in St. Louis, May 23–25, were guests of the Garden at the Arboretum on May 24; and on May 25 they held their meeting in the Museum Building at the Garden. After the meeting a group of out-of-town members consulted some of the rare books in the Garden library.

Dr. G. A. L. Mehlquist, Research Horticulturist to the Garden, will be the official delegate from the Missouri Botanical Garden to the Seventh International Botanical Congress, to be held in Stockholm, Sweden, July 12–20. Later he will participate in excursions relating to genetics and plant breeding in southern Sweden, and will visit botanical gardens in Sweden and Denmark. Other members of the Garden or School of Botany attending the Congress are Dr. Henry N. Andrews, Paleobotanist to the Garden, and Dr. Sergius Mamay, Guggenheim Fellow.

Of those receiving their doctor's degree in June, Dr. Holm has accepted an appointment as Instructor in Biological Sciences at Stanford University, Stanford, California; Dr. Lay will be Lecturer in Botany at the University of Rangoon, Burma; Dr. Mamay has been awarded a Guggenheim Fellowship to study at the University of Cambridge, England; Dr. Etter has been appointed Consulting Biologist to the Water Resources Policy Commission, Washington, D. C.; Dr. Mercer will continue as Assistant Professor of Botany and Pharmacognosy at the St. Louis College of Pharmacy; and Dr. Umanzio will resume the chairmanship of the department of Bacteriology and Public Health, Kirksville College of Osteopathy and Surgery, Kirksville, Mo.

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 50,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until 7:00 p. m.; Sundays, 10:00 a. m. until 7:00 p. m. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah bus line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

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Missouri Botanical Garden Bulletin

Vol. XXXVIII SEPTEMBER, 1950 No. 7

ORNAMENTAL FRUITS FOR AUTUMN AND WINTER

ROBERT W. SCHERY

Widespread attention is ordinarily given to selection of evergreen shrubs and trees for the winter landscape. In St. Louis this in itself is a formidable task, for we are in a climatic zone where deciduous plants naturally predominate and where few broad-leaved evergreens do well when brought in from different zones. We find winter greenness in the omnipresent junipers (such as Pfitzer's Juniper, *Juniperus chinensis pfitzeriana*), Arborvitae (species of Thuja and Chamaecyparis, usually short-lived and unsatisfactory in St. Louis), smaller pines (viz. *Pinus mugo*), yews (several excellent species and varieties of Taxus, somewhat expensive and difficult to establish), hemlock (the genus Tsuga, useful on northern exposures but tending to become too large), and a few other conifers including the Blue and Norway spruces. Among the limited number of broad-leaf evergreens available are: *Mahonia aquifolium*, the Oregon Holly Grape (one of the best, but tending to winter-burn in full exposure); various barberries (viz. *Berberis julianae*, the Wintergreen Barberry; *B. verruculosa*, the Warty Barberry, etc.); several hollies (such as the well-known American holly, *Ilex opaca*, and *I. crenata* and *I. glabra*); members of the Azalea family, which, however, usually demand special cultural care (viz. Japanese Andromeda, *Pieris japonica;* Rhododendron; Mountain Laurel, *Kalmia latifolia*); boxwood, varieties of Buxus (somewhat difficult to establish and expensive); *Magnolia grandiflora* (tends to winter-kill or scald); and for a portion of the winter a few kinds of Viburnum, Evonymus, Cotoneaster, and *Abelia grandiflora*.

With such a limited selection of evergreen shrubs for winter landscaping it is a wonder that more attention is not paid to other features of winter attractiveness in shrubs. For example, winter outline of a deciduous shrub (i. e., whether it presents a pleasing or interesting pattern against a wall or a background of snow, or whether it is a mere "brush pile" best seen at a distance), color of its bark, and size and arrangement of buds, all offer further basis for selection. Yet, after gross habit, winter greenness, and

autumn leaf coloration, colorful fruit is perhaps the outstanding source of ornamentation about the home in autumn and winter. In many shrubs and trees fruits are more colorful and enduring than are the flowers and should rate equal, if not greater, consideration. Not only do winter fruits offer spots of color in an otherwise dreary landscape, but they also may be useful as bird and wildlife food. In the subsequent paragraphs will be discussed some of the more useful shrubs from the winter "berry" standpoint and their value in the St. Louis landscape. Many additions could doubtless be made, but I have intentionally not included the many colorful fruits that seldom last into autumn. The following plants, listed alphabetically according to the name of the genus, is thus mostly confined to those bearing fruits which may be in evidence in October or later.

Aronia (Chokeberry).—This genus of the rose family contains several species useful in distant screens, background plantings, or borders. Among them are the red chokeberry *(A. arbutifolia* and its var. *brilliantissima)* and the black chokeberry *(A. melanocarpa)*, shrubs of moderate height or small trees. As a rule, these do better in more northerly climates and cannot be highly recommended for St. Louis. Among other difficulties they are subject to fire blight, as are many members of the rose family. In selected strains, however, they may yield attractive red fruits *(A. arbutifolia)* or bluish black ones *(A. melanocarpa)* in October. Foliage during the growing season is rather coarse and blends poorly with other shrubs but colors nicely in autumn. The small white or pinkish flowers offer no special inducement for planting.

Berberis (Barberry).—Several barberries offer strikingly colorful winter fruit. The familiar, easily grown hedge and border plant, *B. thunbergii* (Japanese Barberry) is not only one of the most common but one of the best, especially in selected variety. Erect, purple-leaved, and other forms can be had. Good autumn coloration, pleasing foliage, adaptability and hardiness combine with the excellent winter berry characteristic to make this species highly recommended. Its only drawback is its nearly universal use, so that home-owners largely take it for granted. It is free of wheat rust fungus, and the fruit furnishes good bird food. More distinctive are the Chinese *B. circumserrata*, with single or few-clustered yellowish-red fruits; *B. gilgiana* (Autumn Wildfire), with deep red fruit; *B. koreana* (Korean Barberry), with persistent red fruits sought by birds; *B. vernae; B. wilsonice*; and the European barberry, *B. vulgaris*, which, however, is susceptible to wheat rust disease.

Callicarpa (Beauty-Berry).—This member of the verbena family offers at least two Asiatic species, *C. japonica* and *C. dichotoma*, not to mention the native *C. americana*. They are susceptible to winter die-back and have

little to recommend them except their abundant clusters of purplish berries borne in early autumn.

Calycanthus.—*C. florida* and *C. fertilis* may ordinarily not produce seed. However, there is a "strain" at the Arboretum that seems to fruit regularly and the thick, pear-shaped pods are quite interesting.

Celastrus (Bittersweet).—Everyone knows the native bittersweet, *C. scandens*. This vigorous, sprawling, shrubby vine is coarse and unattractive during the growing season but need not take a back seat to any plant when it comes to striking winter fruits. The capsules split open in the dryness of September and display the brilliant orange-red aril of the seed through

American Bittersweet *(Celastrus scandens)* before opening of capsules

autumn and much of winter. Sometimes flowers are unisexual, so that in purchasing bittersweet plants one should be certain to get female or bisexual specimens.

Celtis (Dwarf Hackberry).—Some strains of *Celtis pumila* seem to fruit especially well at the Arboretum. The berries are blue-black and are excellent bird food.

Cephalanthus (Button-bush).—*C. occidentalis* has round seed heads, like those of the sycamore, which persist throughout the winter. It is a native of our river banks, and a good plant for low, wet ground and sunny exposures.

Cornus (Dogwood).—Although the many fine dogwood species are best known for their flowers, a few hold rather attractive cherry-like fruits into

autumn. In good years the Cornelian Cherry *(C. mas)* may bear abundant purplish berries, while the Gray Dogwood *(C. racemosa)* may keep its clusters of white berries borne on pink stalks into October. *C. florida* (Flowering Dogwood) and *C. kousa* (Chinese Dogwood) have reddish fruit. These and other dogwoods are best used as accent plants or in hedge-rows, and are often distinctive for the high coloration of their twigs.

Cotoneaster.—A number of the cotoneasters, members of the rose family, can be recommended on the basis of excellent habit, good foliage, and autumn fruit, although they are poor in flowers, hard to transplant, require sun, and are frequently susceptible to fire blight, winter-kill, or other ailments. *C. adpressa,* with its rich show of red fruits, makes an excellent low accent plant; *C. dielsiana* is said to make good game cover; the fine-foliaged *C. horizontalis* may serve a variety of purposes from ground cover to specimen plant, and is one of the best of the cotoneasters. *C. apiculata* and *C. divaricata* are much like *C. horizontalis*, and *C. zabelii* is another of the spreading species but with more orangish fruits. *C. rosea, C. multiflora,* and *C. salicifolia* are taller species that bear good winter berries. Fruits of all cotoneasters seldom remain bright beyond November. The plants should be prominently placed where they can be viewed at close range.

Crataegus (Hawthorn).—Hawthorns, also members of the rose family, are generally small trees noted both for flowers and colorful red fruit. It is difficult to delimit species in this complex genus, but two of the best species

Hawthorn *(Crataegus)*

are sold under the names of *C. phaenopyrum* (Washington Thorn) and *C. crus-galli* (Cockspur Thorn). The very abundant, small red fruits of the Washington Thorn remain on the tree most of the winter. The Cockspur Thorn is lower and more spreading, perhaps a bit more picturesque as a specimen tree but with less abundant fruit. Many other hawthorns have colorful fruit and show up splendidly as accent plants in borders. For the small yard hawthorns are usually too large to be used to best advantage. They are relatively hardy, but, like many other members of the rose family, may fall prey to fire blight.

Elaeagnus (Russian Olive).—Most species of Elaeagnus are noted for their bright silvery leaves and twigs, but a few bear salmon or red fruits into October. The Asiatic *E. umbellata* and the doubtfully winter-hardy *E. pungens* and *E. multiflora* are most noted in this respect. Russian Olives are small trees, doing best in full sun and requiring considerable space.

Evonymus (Spindle Tree or Wahoo).—The genus Evonymus is in the bittersweet family, and species typically bear red or orange arillate seeds similar to those of the well-known bittersweet. Some species are prostrate or vine-like (*E. fortunei* in variety), others attractive shrubs (*E. kiautschovica, E. alata, E. yedoensis*), and a few are trees (the native *E. atropurpurea* and *E. americana*, the Asiatic *E. bungeana*, and the European *E. europaea*). The shrubby species and *E. europaea* and *E. atropurpurea* can be recommended for their autumn fruit display. They are also desirable on other counts, transplanting well, having fine autumn leaf coloration, and showing interesting winter outline (especially Winged Wahoo, *E. alata*, with four corky ridges down the twigs). Most species are best used for accent or specimen display. Several are readily attacked by scale.

Grewia.—Grewia is so little known as not even to be mentioned in most landscape books. *G. biloba* is a coarse, sprawling shrub of the basswood family (Tiliaceae), with inconspicuous summer flowers but curious (although dull) 4-lobed orange-red autumn fruits that are quite attractive.

Hamamelis (Witch-hazel).—Witch-hazel has little to recommend it as more than an occasional or background shrub, although the slender-petaled, spidery flowers of *H. vernalis* or the Chinese *H. mollis* may be found open on any warm day from mid-winter to early spring. *H. virginiana* flowers in autumn. All species bear large, dull, woody capsules perhaps of mild interest through the winter in that they remain on the plant for about a year.

Ilex (Holly).—Probably only the Spindle Trees (Evonymus), the Barberries (Berberis), Hawthorns (Crataegus) and Viburnums offer as much in attractive winter fruit as do the hollies. American Holly (*I. opaca*), the source of the common Christmas green, is best known. This evergreen tree,

American Holly *(Ilex opaca)*

native to the southeastern United States, is one of the finest of all ornamentals. Equally or more colorful in fruit, but shedding the leaves in winter, are the Winterberry *(I. verticillata)*, Deciduous Holly or Possum Haw *(I. decidua)*, and similar species. Several other attractive species are southern and doubtfully hardy in St. Louis, while the useful Japanese Holly, *I. crenata*, has a black fruit not of value for autumn coloration. In this genus, as with bittersweet, a purchaser of plants should be certain of getting trees with female flowers, for often they are unisexual. Hollies are sometimes difficult to transplant, but require little care once established.

Juniperus (Juniper or "Cedar").—The smoky-blue cones of juniper "berries" of the native *J. virginiana* and of a number of the spreading species such as *J. scopulorum*, *J. communis*, and *J. horizontalis* are very attractive through autumn and winter. In selecting these evergreens for winter fruit care must be taken to insure that plants bear female cones.

Ligustrum (Privet).—Privets, members of the olive family, are best known as exceptionally hardy and adaptable hedges or fine foliage shrubs. They will also hold the blue-black fruits into early winter, and may be mildly

Red Cedar *(Juniperus virginiana)*

ornamental in this respect. Regel's Privet, *L. obtusifolium regelianum*, is perhaps the most satisfactory. Privets are among the most easily grown shrubs.

Lindera (Spicebush).—The aromatic *Lindera benzoin*, a member of the laurel or sassafras family, bears red fruits for a brief time in early autumn. It is a coarse shrub of limited usefulness except for naturalistic plantings.

Lonicera (Honeysuckle).—Many of the bush honeysuckles bear attractive, colored berries (viz. *L. tatarica*) but only a few last into October. Latest fruiting is the Amur Honeysuckle, *L. maackii* var. *podocarpa*, whose dark red berries ripen in September and usually persist into October. Of course, too, the various honeysuckles have much to recommend them for shrub borders and flower beds.

Lycium (Matrimony Vine).—Both the Chinese Matrimony Vine, *L. chinense*, and the common European species, *L. halimifolium*, produce attractive red-orange fruits, like small chili peppers, that remain on the shrub well into autumn. A vigorous, spreading "weedy" plant without especial ornamental value other than fruit, the Matrimony Vine has fallen into disfavor in modern times; yet it is worthy of resurrection for rough land and distant plantings where it will help hold soil and serve as cover for small game.

Laland Firethorn *(Pyracantha coccinea lalandii)* trained on a trellis in the Linnean Garden

Magnolia.—Almost any of the small tree magnolias bear "cobs" of red-berried fruits in autumn that are very striking for some weeks until becoming dull or the seeds drop. The evergreen M. *grandiflora* is doubtfully winter-hardy in St. Louis, but many of the deciduous species such as M. *virginiana*, M. *tripetala*, M. *macrophylla*, and M. *fraseri* can be recommended for attractive fruits and are not over-planted as is the Saucer Magnolia, M. *soulangeana*. Magnolias are generally difficult to transplant, but once established require little care. Most of them are somewhat too large and coarse-leaved for the small place.

Malus (Apple and Crab-apple).—There are many excellent ornamental crab-apples, although the great majority of species are sought not for fruit but for their charming fragrant blossoms, their graceful habit, and blending value as a small lawn or border tree. All will thrive where orchard apples will, and are subject to the same ills and necessities of care. *M. arnoldiana* and M. *toringoides* bear yellow-red fruits; M. *hupehensis* small purplish ones; M. *sargentii* long-persisting cherry-like pomes; and varieties and hybrids of M. *baccata* apples in shades of red, into September and October.

Nandina (Heavenly Bamboo).—*N. domestica*, a relative of the barberries, bears attractive, edible, purplish-red fruits in autumn. It is winter-hardy only with special care in the St. Louis area.

Photinia (Christmas Berry).—*P. villosa*, a member of the rose family, is a small tree similar to the hawthorns, with which it has at times been classified. The species is best used for accent in borders, the attractive fruits ripening in late summer and often persisting into winter.

Ptelea (Wafer Ash, or Potato-Chip Tree).—*Ptelea trifoliata* has been known to hold its fruit until well past January. The seeds could be colored and used in decoration.

Pyracantha (Firethorn).—The Laland Firethorn, *P. coccinea lalandii*, has the reputation of being one of the finest small trees noted for ornamental fruit. The fruit is showy and is often held throughout the winter. Unfortunately, it has proven difficult to grow in St. Louis, succumbing to fire blight and other ills. It is closely related to the hawthorns and may be similarly handled. The species is adaptable to espalier training, and one such specimen can be seen as an attractive wall or trellis plant in the northwest corner of the Linnean Garden.

Rhamnus (Buckthorn).—*R. caroliniana* (Indian Cherry) bears fruit which persists until midwinter. It is a native plant with no especial "troubles" and should be used more often in our gardens. *R. cathartica*, too tree-like to be of much use in a shrub planting, bears blackish fruit in September that may sometimes last into October. *R. davurica* is a picturesque

Common Buckthorn *(Rhamnus cathartica)*

irregular-branching bush that bears shiny black fruit persisting into autumn and winter.

Rhus (Sumac).—This genus includes several vigorous, coarse, compound-leaved species spreading readily by root "suckers." Their greatest ornamental value lies in their brilliant autumn coloration and terminal clusters of small reddish fruits often lasting well into winter. Smooth Sumac *(R. glabra)*, Staghorn Sumac *(R. typhina)*, and Shining Sumac *(R. copallina)*, usually available in cut-leaf variety, are among the outstanding taller types. *R. aromatica* is a smaller trifoliolate species. All are readily grown in this area.

Rosa (Roses).—The many types of roses are too well known to need much comment. A number of the shrub or trailing types bear reddish hips that remain well into winter and afford excellent cover and food for small game. Native species such as the Prairie Rose, *R. setigera*, can be highly recommended in this respect. In recent years widespread attention has been given by sportsman's organizations and conservation groups to the planting of the Japanese *R. multiflora*. One of the earliest plantings of this species in the state was at the Arboretum grounds. *R. rugosa* and *R. blanda* are other cultivated species unusually colorful in fruit.

Sambucus (Elderberry).—The elderberries, members of the honeysuckle family, are colorful in fruit but coarse and mostly unattractive otherwise. The voluminous purplish berries fall quickly, seldom lasting through October,

but are momentarily colorful and useful for encouraging wild life. The Red-berried Elder *(S. racemosa)* is an European introduction, while the more familiar American S. *canadensis*, abundant in the wild in Missouri, is known as the source of elderberry wine.

Sorbus (Mountain Ash).—S. *americana* and the very similar European S. *aucuparia* are among the finest of small trees for colorful, clustered fruit, but, like certain other members of the rose family, are attacked by fire blight and other ills in the St. Louis area.

Staphylea (Bladder-nuts).—S. *trifolia* has little to recommend it as an ornamental, although the inflated, 3-lobed brownish capsule affords moderate interest in the autumn. The European S. *pinnata* and S. *colchica* are doubtfully winter-hardy here.

Symphoricarpos (Coralberry and Snowberry).—The Coralberry *(S. orbiculatus)*, also known as Indian Currant, Buckbrush, Snapberry, and Tur-

Snowberry *(Symphoricarpos albus)*

Viburnum molle

High-bush Cranberry *(Viburnum opulus)*

keyberry, is a tough small-shrub weed of roadsides, common throughout Missouri. It is of great value for holding soil, tying-in large shrub groups to the lawn, and also for supplying food for small game. The clusters of hairy reddish fruits are usually conspicuous throughout the winter. S. *albus*,

the Snowberry, is a familiar cultivated species that bears white fruits through autumn. It is a rather untidy shrub and has little to recommend it other than hardiness and the attractive fruit. *S. chenaultii* is a more desirable hybrid between the Coralberry and a Mexican species.

Symplocos (Sapphire Berry).—*S. paniculata* is a large, well-shaped shrub with bright blue berries maturing in September. These are generally quickly consumed by birds. Flowers are often unisexual, so that care should be taken to procure fruiting plants.

Taxus (Yew).—Like the junipers, the yews are evergreen conifers, and by far the most important gymnosperm from the standpoint of autumn coloration. "Cones" consist of naked ovules in which the outer integument becomes fleshy and bright red. Yews are normally expensive and offer some difficulty in establishment, but can be very highly recommended. The English Yew (*T. baccata* in many varieties) sometimes winter-kills, but the Japanese Yew (varieties of *T. cuspidata*), *T. canadensis*, and *T. media* (a hybrid between *baccata* and *cuspidata*) are winter-hardy in this area.

Viburnum (Snowball, High-bush Cranberry, etc.).—Viburnum, of the honeysuckle family, is one of the best all-around genera in cultivation. A number of species bear very ornamental fruit clusters, several holding fruits into autumn. Bearing red fruits are the Linden Viburnum *(V. dilatatum)*, High-bush Cranberry *(V. opulus)*, Tea Viburnum *(V. setigerum)*, and Siebold's Viburnum *(V. sieboldii)*. Having late yellow fruits is *V. opulus xanthocarpum*. With blue or black fruits are Withe-rod *(V. cassinoides)*, Nannyberry *(V. lentago)*, Black Haw *(V. prunifolium)*, Arrow-wood *(V. dentatum)*, and *V. molle*. All are large border shrubs, generally easily grown. Some have an objectionable odor. Many additional species of value could be listed, but the above are among the later fruit-bearing sorts.

LARGE TREES

Few trees offer much in the way of ornamental fruits for winter. The Sweetgum *(Liquidambar styraciflua)* bears large, orbicular, spine-studded capsules that frequently hang on the tree through winter. These may make quaint Christmas ornaments when gilded. Similar but less distinctive are the "monkey balls" of the Sycamores (Platanus), common as street trees in St. Louis. Some of the leguminous trees retain their pods into winter. The long thin legumes of the Honey Locust *(Gleditsia triacanthos)* and the large thick pods of the Kentucky Coffee Tree *(Gymnocladus dioicus)* hang grotesquely from the branches through most of the winter.

Persimmons (Diospyros) are one of the best-known fleshy autumn fruits. A tree well-filled with these edible frosty blue berries is not unattractive ornamentally. Certain strains retain their persimmons through most of the winter. Similar to persimmons are the dark blue berries of Sassafras *(Sassa-*

fras albidum), sometimes borne abundantly into October on the female trees. The Osage-Orange or Hedge-Apple *(Maclura pomifera)* bears fleshy green fruits, larger than a baseball, that are of interest chiefly to small boys.

The long, slender lady's cigar capsules of the Catalpa are more grotesque than ornamental, but do contribute variety to the arborescent winter outline. Ashes (Fraxinus) and boxelder *(Acer negundo)* may retain their winged, "maple squirt" type fruit into winter, although these are hardly ornamental. The fruits and shiny seeds of some of the Horse-chestnuts or Buckeyes (Aesculus) may hang on beyond fall of the leaves. *A. hippocastanum* bears an unusually intriguing spiny capsule. Tulip Tree *(Liriodendron tulipifera)* may hold its dehisced clusters through the winter, but again these are of negligible ornamental value. Equally inconsequential from the ornamental standpoint are acorns of oaks, chestnut and beech capsules, walnut, butternut and hickory drupes, alder "cones" etc., although all these may be of considerable local interest or value to wildlife.

FRUIT GROWING FOR THE HOME ORCHARD

AUGUST P. BEILMANN

It seems that the city dweller has a strong affection for the soil and in time a great many realize their ambition to live on some small acreage where they can harvest their own fruits and vegetables. Since most vegetables are annuals it is possible for the gardener to accumulate sufficient experience in growing them in a short while. Fruit growing is quite another matter. It begins with the proper selection of varieties, and little can be done to correct a serious mistake in that regard. Of course, a clear picture of a proper orchard site should be acquired before the land is purchased, but often the new owner is confronted with the problem of growing what he can, no matter how ill-favored the site may be.

It is seldom possible to grow many kinds of fruits, but the orchardist might begin with apples, then try peaches, with cherries, pears, plums, and apricots following in that order. Exactly what will grow on any particular piece of ground with the innumerable conditions to be found within fifty miles of St. Louis is rather hard to determine. Generally, the kind of fruit trees which have done well in that neighborhood would be recommended. An area that is almost without the stone fruits is not likely to grow them successfully. Similarly an area famous for peach production will probably grow peaches far better than pears. On the whole, the apples are easier to grow than the stone fruits, although they may prove quite a disappointment for the embryo orchardist who hopes to grow enough for canning, home use, and distribution to friends. He might select his varieties from the following list:

APPLES:

1. *Golden Delicious.*—For those who want an apple of many uses, early and dependable bearing, good size, and easy growth, this apple is one of the best. It is greenish-golden when ripe in late summer.

2. *Yellow Transparent.*—This small green apple can be picked before the Fourth of July. It does not have the keeping quality of the summer or fall apples, but it is especially good for the home orchard since it ripens when none but storage apples are available. It is hardy and a general-purpose fruit and reaches its peak as a cooking apple.

3. *Grimes Golden.*—This is a late yellow-green apple which has an excellent flavor when well grown, and perfectly suitable as a dessert apple. However, for the small orchard, it may be unsatisfactory since the tree is seriously attacked by collar rot and the cedar apple rust.

4. *Rhode Island Greening.*—Another greenish-yellow winter apple most valuable for cooking, especially in pies.

5. *Banana.*—This variety is most satisfactory in the home orchard, having a distinctive flavor and an interesting color.

6. *Red Delicious.*—This is a late summer and fall apple and of major importance in commercial plantings. A great many forms are available and almost any of them reach top quality in a Missouri summer. They do not bear as young as some varieties, and the household may become discouraged waiting for the tree to come into fruit.

7. *Duchess.*—This old variety can be obtained in improved forms. It has one advantage for the home orchard in that the tree is rather small. It is an excellent cooking apple of the summer season.

8. *Cortland.*—This development of the McIntosh type is probably best suited for the North. A few of these may be used in the home orchard by those who remember and like the old McIntosh.

9. *York Imperial.*—The newer forms of this variety have better color than the old ones and therefore are more attractive. It is a good Middle Western apple and can be used in almost any fashion.

The list of better red apples might be continued indefinitely. Some are excellent producers but distinctly lacking in quality when grown in this region. The old stand-bys such as Winesap, Ben Davis, Baldwin, Jonathan, and Rome Beauty have a place only when ample room is available. Willow Twig, too, may be included for its heavy crop, but it lacks the quality the home-owner requires.

If the home grounds are large, the standard commercial tree will be satisfactory, but there are varieties grafted on dwarfing stock for smaller grounds.

Although these dwarf plants are expensive and not quite as dependable as the standard tree, they come into fruit very early, and are easy to spray and prune and are not too tall for easy harvesting.

Apples are more difficult to care for than most other crops. They have their usual quota of enemies in the form of insects and diseases which must be controlled in order to obtain good fruit. Spraying is therefore a major operation, but the newer insecticides and fungicides have lightened this job somewhat. Normally, the codling moth is the most serious pest in apple-growing regions. The mites and leaf-rollers may be important at times. The use of D.D.T. and Parathion plus some arsenate of lead will give the home orchardist adequate control over these pests. As new materials are developed, the information about them and a suggested schedule is made available regularly through the state horticultural societies and the state and government fruit stations. Membership in these societies will keep the grower abreast of the times and aid in producing the high quality fruits he has a right to hope for.

Apple trees are normally very long-lived, but with the constant introduction of new and better varieties there seems to be no reason for developing an orchard with the thought that it will remain productive for a hundred years. It is probably better to think of apple varieties as desirable for about twenty-five years. So long as fertility of the soil is maintained apples will do well on almost any site except on a south or west exposure when planted in a shallow soil that is quickly saturated during a rain and which dries out just as rapidly. Most varieties of apples are winter-hardy in this area, but those developed for the northern states are not as satisfactory as other varieties.

Young apple trees should be purchased only from a reputable nurseryman, and it is not necessary to buy the biggest trees that are available—sometimes the small ones will catch up and even outgrow a larger and older tree. Most standard forms of apples require about forty feet of space in which to mature. The dwarf forms require only half of that, but less space might be given to either kind of tree in the home orchard. Another method of utilizing the entire area is to interplant the permanent apple trees with the shorter-lived peach. At the end of fifteen years the peach will have reached maturity and will need to be replaced and the apple tree will have grown so large that it requires the full forty feet to mature.

PEACHES:

Growing peaches in Missouri is much more of a gamble than growing apples. The home orchard can, however, grow a number of varieties maturing from very early until late, but ordinarily "real" peaches are thought of as those approaching the Elberta in size, taste, and attractiveness. The

peach has certain peculiar requirements as to site and exposure which are not quite so important to the apple. Peaches must not be grown where there is a lack of air drainage. Cold-air pockets favor late frosts which always injure the flowers.

Peaches are subject to a number of diseases and insect pests. One of the most disheartening experiences for the home orchardist is to discover brown rot which shows up just about harvest time. Peaches so infected will collapse over night when picked ripe and stored in a warm room in anticipation of freezing and canning. Brown rot is controlled by sulphur sprays. An insect which has always been a serious pest, particularly to the home orchardist, is the peach tree borer which can successfully be controlled by D.D.T.

Peaches have certain specific pruning requirements which set them apart from the other fruit trees. Peach trees are normally cut back very severely, but the more leaves the tree has the greater the chance of a crop. Through the use of greater quantities of nitrogenous fertilizer applied annually it is possible to prune less and allow the trees to grow to greater size. Commercial plantings have usually been considered as short lived, with the expectation that two or three crops in fifteen years will yield a profit. This is hardly the kind of program that would interest a home orchardist who wants a variety of dessert peach which will produce almost every year. The standard, of course, is Elberta and its many varieties and hybrids. These, along with J. H. Hale, are nearly all mid-season peaches. There are a few earlier varieties of which Red Bird and Alton are among the best known. Most of the early peaches are clingstones, which may be objectionable for certain home uses. The good late peaches are October Krummel and Heath Cling. To round out a complete harvest calendar the home grower might add a number of other varieties to those listed above.

CHERRIES:

Extremely fine varieties of both the cherry and the plum are available on the market in the proper season. Unfortunately, neither of these fruits are much at home in the Middle West. Both require a very fertile soil, and the varieties which are hardy in the region about St. Louis may have far less quality than those grown in other areas. However, they are much more dependable in bearing habit than the peaches, but require a good deal more labor at harvest time. Cherries vary considerably in color; yellow, white, red, and almost black varieties can be obtained. There are three major classes of the fruits—the sweet, the duke, and the sour. These are Old World plants, and generally little difficulty is experienced in growing a small sour cherry in this region, but the better varieties of the duke and

yellow sweet cherries are increasingly difficult. One of the best early sweet cherries for this region is the Seneca; then Lambert might be used, with Gold for a later crop.

PLUMS:

The plums are famous for their high fertility requirements. It is perhaps noteworthy that most of the home orchard plums have succeeded in the chicken yard. Excellent varieties are available for Middle Western planting, but even the best can not compare with the marvelous fruits shipped from the West. However, the home orchardist, looking forward to a crop of fruit from his own trees, can find satisfactory varieties for this locality. Freshly picked fruit may well compensate for the smaller size and somewhat reduced quality. There are several major classifications of plums and these vary considerably in taste. The first are the Damsons which are small firm plums of many colors, being borne in clusters. Next are the Gages of higher quality, and the third includes the red, the blue, and the purple varieties, some of which yield the "prune" of commerce. Normally, the home-owner need not bother about the pruning problem. Each variety has a more or less characteristic growth and little pruning is required. Like the cherry, the plum industry is largely confined to a particular section of the country. Omaha, Green Gage, and Gold Plums are among the best mid-season types. The Damsons and the Wild Goose are among the best in the late plums.

PEARS:

In the Middle West we can't hope to grow the marvelous pears which occasionally find their way to our tables from the Northwest. However, certain varieties can be grown with a greater degree of dependability than almost any other tree fruit. Unfortunately, the Kiefer, which is grown so extensively, has caused many people to believe that pears are hardly worth growing. Perhaps the second most common variety is the Bartlett, which again is somewhat inferior in quality although it is a standard commercial variety. To this list might be added the Lincoln, which is better in quality; the Seckel, which ripens in late summer; and Gorham which is rated as a "late" Bartlett.

Pears require but little pruning and not very much fertilizer. Their spraying requirements are not as critical as most other fruits, but they have one bacterial disease called fire blight which may destroy a small tree in a few weeks. This disease, more than any other difficulty, has limited pear-growing to certain parts of the country.

Many home orchardists will feel lost without a few nectarines, apricots, and crab-apples. These fruits will prove successful under certain exacting conditions, but, on the whole, they should be planted only after considerable

experience has been gained in the growing of tree fruits. There are varieties of apricots reported to stand twenty below zero, and nectarines of equal hardiness are reported available. However, winter hardiness is not the only basis for judging fruit trees. Types of crab-apples developed from American species are so seriously injured by cedar apple rust that only the most exacting spray will keep them alive. However, if the orchard is in an area free of Red Cedars any one of the commercial crab-apples might be perfectly satisfactory.

NOTES

Mr. George H. Pring, Superintendent of the Garden, attended the meeting of the trustees of the American Orchid Society, at Ithaca, N. Y., September 5-6.

Mr. Christoph B. Schuecking, Landrat des Kreis (Chief County Officer), Lauterbach, on a tour to study agriculture and local government under the auspices of the U. S. Occupation Forces, spent a day at the Arboretum, observing the farming, forestry, and cattle.

Dr. Edgar Anderson, Dr. Henry N. Andrews, Dr. Robert W. Schery, Dr. Rolla M. Tryon, Dr. George Van Schaack, and Dr. Robert E. Woodson, of the Garden staff, and Mr. Hugh Iltis, Mr. David J. Rogers, and Mrs. Rolla Tryon, graduate students at the Garden, attended the conference of biological societies, under the sponsorship of the Institute of Biological Sciences, held at Columbus, Ohio, September 11–14.

Dr. Edgar Anderson, Geneticist to the Garden, has received a grant from the John Simon Guggenheim Foundation to assist his researches into the origin and development of cultivated plants in the New World. Part of the grant will be used to operate an experimental plot at the Escuela Agricola Panamericana, Tegucigalpa, Honduras. Mr. George Freytag, a former graduate student at the Garden, will spend the academic year 1950-1951 assisting Dr. Anderson at the Escuela Agricola Panamericana.

Dr. Carroll W. Dodge, Mycologist to the Garden, gave a course in medical mycology at the Instituto de Microbiologia of the Universidad de Santiago, Chile, from June 18 to July 28. While in Chile he was made an honorary member of the Faculty of Natural Sciences and Medicine of the National University of Chile, and of the Sociedad Chilena de Dermato-Sifilogía. During August and September he visited various scientists and scientific institutions in Argentina, Brazil, Ecuador, Peru, and Costa Rica.

Visitors to the Garden library and herbarium during the past several months were the following: Miss Elizabeth Berlin, of Mexico City; Mr. W. N. Brandt, of the Western Cartridge Co., Alton, Ill.; Rev. Robert R. Brinker, O.F.M., of Quincy College, Quincy, Ill.; Dr. John N. Couch, of the University of North Carolina, Chapel Hill; Dr. Hugh C. Cutler, of the Chicago Museum of Natural Sciences; Mr. R. A. Evers, of the Illinois Natural History Survey, Springfield; Dr. David H. Fairburn, of the McKee Jungle Gardens, Vero Beach, Fla.; Mr. John J. Finan, graduate student in history of science at Harvard University; The Gillespie Community School, Gillespie, Ill.; Dr. D. J. Glover, of the University of Liverpool, England; Dr. George B. Happ, of Principia College, Elsah, Ill.; Dr. Charles B. Heiser, of the University of Indiana, Bloomington, and a group of his advanced students in botany; Mr. Norland Henderson, graduate student, University of Indiana; Dr. Margaret Kaiser, of Southern Illinois University, Carbondale, accompanied by a group of students in botany; Dr. Anna H. Koffler, of the University of Kansas City, Mo.; Mr. G. Edward Nicholson, of the Food Supply Division, Institute of Inter-American Affairs, Lima, Peru, who spent several weeks consulting the Garden library and herbarium; Dr. S. L. Ransom, of the University of Durham, Newcastle-on-Tyne, England; Dr. Jonathan Sauer, of the University of Wisconsin, Madison; Dr. Russell J. Seibert, of the Los Angeles State and County Arboretum, Arcadia, Calif.; Dr. Lloyd H. Shinners, of Southern Methodist University, Dallas, Texas; Dr. J. N. Prem Singh, of the Lalbach Botanic Gardens, Bangalore, India; Mr. Oliver Tucker, of the Tucker Nurseries, Columbus, Ohio; Mrs. Richard Walker (Helen Bramsch), of the University of Washington, Seattle; Dr. Eula Whitehouse, of Southern Methodist University, Dallas, Texas.

This time of year, when those who force bulbs for winter bloom are getting in their supplies, is a good time to bring up again the special merits of FEBRUARY GOLD, the early yellow trumpet daffodil. It is usually listed in catalogues among rock-garden narcissci or with the *cyclamineus* hybrids, where it technically belongs. Actually it forces more easily than any other daffodil, almost as easily as the paper-white narcissi. The flowers are not as large as those of the ubiquitous KING ALFRED and they are not quite so super-yellow. They last better, they force much more readily in the earlier part of the winter, and they are small enough so that twice as many can be planted in a small pot, giving an abundance of bloom that more than makes up for the smaller size of the individual flowers.

THE MISSOURI BOTANICAL GARDEN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 50,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until 7:00 p. m.; Sundays, 10:00 a. m. until 7:00 p. m. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah bus line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

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Cover: Linnean House Garden in the summer. Photograph by Robert W. Schery.

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AUTUMN COLORATION IN MISSOURI

ROBERT W. SCHERY

The question as to why leaves color in autumn has long been of interest to botanical science, but remains to this day a problem not completely understood. Apparently a multitude of interacting factors are involved, including cooling weather, shortening days, physiologic condition of the plant, sequence of rainy or overcast vs. clear, dry spells, and a number of others. The sum total of these changing conditions causes the plant to behave in a characteristic way, whereby the usually predominating green pigment becomes less abundant permitting other pigments to show through, while additional color pigments may also be developed. To better understand this sequence of events let us briefly consider the kinds of pigmentation found in a tree leaf.

The Greens.—The ubiquitous greenness of foliage is due to complex pigment molecules called chlorophylls that occur in shades from bluish-green to yellowish-green. While the chemical formula of chlorophyll has been deciphered, its exact mode of formation and its breakdown or destruction remain poorly understood. For one thing, light is necessary for its formation, but too intense light or ultraviolet rays seem to destroy the pigment (or inhibit the mechanism whereby it is made?) faster than the plant can replenish it. It may be that the crisp, clear days of autumn are partly instrumental in reducing the quantity of chlorophyll at a time when the physiological activities of the leaf are slowed down by coolness or other factors to a pace incapable of replenishing chlorophyll loss. This would account for the gradually disappearing green in autumn color. The chlorophylls occur in minute bodies in the leaf cells, called plastids; they are not free in the plant "juices" or sap. They are, of course, the means whereby the green vegetable world harnesses the energy of sunlight for the building of foods (photosynthesis), and thus constitute almost the sole means for sustaining life on our planet.

The Yellows and Oranges.—Normally associated with chlorophylls in

greater or lesser quantities and various combinations, but masked by the more intense greens, are complex yellowish pigments (flavones) and orangish pigments (carotinoids). Again their exact function is obscure, but there is evidence that they aid in photosynthesis and are useful as vitamin precursors or vitamin-like enzymes. Carotin, for example, responsible for the orange color in carrots, is readily transformed into vitamin A. In autumn, as the green chlorophylls disappear, the carotinoids and flavones, apparently not so easily destroyed, show through and give to the hardwood forest its delightful brightness of gold and orange. Carotinoids occur with chlorophyll in the plastids, while flavones are like the anthocyanins (next paragraph) in that they are soluble in the cell sap.

The Reds and Purples.—A totally different group of pigments not found in the plastids but soluble in the cell sap are the reddish or purplish anthocyanins. Again the function of anthocyanins is not definitely known, but they may serve as a "shield" for the chlorophyll against too intense sunlight. They are also associated with cooler temperatures and high sugar concentration in the cells, characteristically develop best in alpine plants or under autumn conditions or in plants exposed to intense sun. It was formerly thought that high sugar concentration developed in the leaves in autumn because of intense photosynthesis in the bright sun, while conduction of the sugar away from the leaf to stem and root was at least partially prevented by development of a corky "abscission layer" of cells at the base of the leaf stalk. This has recently been shown to be generally untrue, although there is little doubt that with cooler weather, for one cause or another, conduction and transportation within the plant are slowed down. This could account for more ready accumulation of sugars in the leaf cells. Plants generally build up a higher concentration of soluble materials in living cells as winter approaches, a sort of "anti-freeze" precaution for coming cold months. In any event, under autumn conditions anthocyanins seem to form readily, and in the absence of the more susceptible (to autumn conditions) chlorophylls show through as the brilliant reds and dark purples of sumac and oak.

The Browns.—All deciduous leaves turn brown when the cells are dead or dying and the other pigments have disappeared, usually after a heavy frost. Partially dead tissues may lend darker tones to autumn leaves and blend with the other types of coloring above mentioned to produce some of the beautiful bronzes that contribute to the autumn glory of Missouri woodlands.

Only among deciduous trees (i.e. not evergreens) do the leaves change color in autumn, and Missouri is among the elite in our country in that she occupies a portion of the deciduous hardwood forest belt, a belt constituting only about 30 per cent of the forest land of the nation. Missouri autumns

perhaps lack the brilliance of those in favored spots of New England, for our forests have considerably less hard or sugar maples, one of the gorgeous trees of the autumn landscape. However, we find compensation in a sassafras that the North knows but little, and can glory on a bright day in the darker reds of the native oaks.

Below are listed, more or less in the order of their value, some of the more common Missouri trees which are outstanding in autumn coloration. It must be realized that the same species may not color exactly the same or in the same sequence in different years or locations. In fact, parts of the same tree may vary in color; it is not uncommon to see most of a hard maple golden-yellow with one section or large branch bright reddish-orange, or one leaf of a sassafras part yellow and part orange. Many trees are first yellow then later orange or red as anthocyanins develop. The autumn panorama, then, is seldom of identical hue on any two successive days or succeeding years.

EARLY-COLORING TYPES

Sumacs (*Rhus* spp.)—The various sumacs offer the first bright autumn coloration, a brilliant red. These are more shrubs than trees, and are ordinarily in color by late September. They are outstanding in front of a green background or a different-coloring plant such as sassafras. Smooth Sumac *(R. glabra)* and Fragrant Sumac *(R. aromatica)* are probably most commonly seen, and in cultivation the Staghorn Sumac *(R. typhina)*.

Sassafras *(S. albidum)*.—On a par with sumac and almost as early to color is sassafras. Leaves first turn a bright yellow then change to brilliant orange or reddish-orange. This is an outstanding autumn tree but one commonly neglected for planting about the small place.

Black Tupelo *(Nyssa sylvatica)*.—This tree is found scatteringly in southern Missouri, where it early contributes spots of bright red foliage amidst a predominating green canopy of oak. By the time other trees color, the leaves of Black Tupelo are gone, but its early blaze of glory is worthy of admiration.

Virginia Creeper *(Parthenocissus quinquefolia)*.—This early-coloring native vine is conspicuous for its bright red foliage which is striking against the usually still-green tops of trees through which it is apt to climb. Were this vine a bit more frequent it would rate with sumacs and sassafras as an important contributor to our autumn coloration.

Tulip-tree *(Liriodendron tulipifera)*.—Uncommon in the wild in Missouri but frequently planted about the city, this large tree is of only modest autumn-color value. In fact, the very early shedding of its yellow leaves is considered one of its more objectionable features.

Dogwoods *(Cornus* spp.*)*.—Most dogwoods attain a dark red or purple coloration rather early. However, as the colors are usually rather dull and the trees inconspicuous in the under-story, they do not contribute greatly to autumn coloration.

LATER-COLORING TYPES

Maples *(Acer* spp.*)*.—Hard and Red Maples (*A. saccharum, A. rubrum,* and a few other species) rank with sumac and sassafras in brilliance of autumn display, and because of their larger size probably rate No. 1 among autumn coloring plants. They turn a bright gold to brilliant orange rather soon and hold their fine color for some days. Soft Maple *(A. saccharinum)* is a dull yellow and of little consequence in autumn coloration.

Hickories *(Carya* spp.*)*.—Such characteristic woodland species as the Shagbark Hickory *(C. ovata)* turn an attractive but not brilliant yellow before the oaks, about the time the maples change. They rate well as autumn-colorers and are fairly frequent.

Oaks *(Quercus* spp.*)*.—Oaks generally are among the last trees to color. They turn a rather dark, often brownish-red which appears brilliant against a rising or setting sun for at least a few days. Because of their frequency in the Missouri landscape they rate as mainstays in autumn coloration, although individually they are probably not as attractive as maples, sumacs, or sassafras. One interesting feature is the tendency of some of the leaves or tips of leaves to turn a rather bright red while the greater part is still green. Among the better-coloring local oaks are the Scarlet Oak *(Q. coccinea,* south of St. Louis*)*, Pin Oak *(Q. palustris,* frequently planted*)*, Red Oak *(Q. shumardii* in var.*)*, Northern Red Oak *(Q. borealis* in var.*)*, White Oak *(Q. alba)*, and other related species.

Sweet-gum *(Liquidambar styraciflua)*.—Sweet-gum is another tree that provides a dark red tone to the late autumn scene. The tree is rare in the wild except in the extreme southeastern part of the state, but is familiar to almost everyone as a lawn tree. Preliminary yellowing of the star-shaped leaves offers nothing outstanding, but the purplish-reds that follow, although not glossy-bright, present a very attractive coloration enhanced by the pendent spiny fruits and grayish-ridged bark of the twigs.

Ashes *(Fraxinus* spp.*)*.—Various ashes, particularly the Green Ash *(F. pennsylvanica lanceolata)*, contribute a moderately bright yellow to our autumn landscape, much like the yellow of the hickories. Ashes are usually not so frequent in the wild as are hickories, but they are perhaps more commonly planted as lawn trees. The yellow of the pinnate ash leaf appears to best advantage in the sun, seen against a bright blue sky studded with billowy white cumulus clouds.

SYCAMORE *(Platanus occidentalis)*.—The rather dull yellow of sycamore foliage is not in itself especially attractive, but against the very white bark of the younger branches it forms a combination of unusual interest. Sycamores are most abundant along water-courses, where their unusual bark offers ornamentation throughout the winter.

WALNUT AND BUTTERNUT *(Juglans nigra* and *J. cinerea)*.—These species, only moderately frequent, present rather dull yellow and brownish-yellow colors in autumn. They only serve to supplement the more conspicuous color of other species.

WILLOWS *(Salix* spp.*)*, POPLARS *(Populus* spp.*)*, BIRCHES *(Betula* spp.*)*, ELMS *(Ulmus* spp.*)*, HACKBERRIES *(Celtis* spp.*)*, MULBERRIES *(Morus* spp.*)*, WILD CHERRY *(Prunus serotina)*, BLACK LOCUST *(Robinia pseudo-acacia)*, HONEY LOCUST *(Gleditsia triacanthos)*, BUCKEYE *(Aesculus glabra)*, TREE-OF-HEAVEN *(Ailanthus altissima)*, BASSWOOD *(Tilia* spp.*)*, PERSIMMON *(Diospyros virginiana)*, and CATALPA *(Catalpa* spp.*)*.—These trees are generally of little autumn interest. The foliage of all turns a rather dull yellow usually quickly browning, or it falls. Locally some may be of importance [as are a number of species not listed—viz., Hawthorns *(Crataegus* spp.*)*, Shadbush *(Amelanchier)*, etc.], but, by and large, the attractiveness of our autumn landscape hinges not upon these but upon the species mentioned in the preceding paragraphs. The Aspen Poplar *(Populus tremuloides)* offers a spectacular golden among coniferous trees in northern or mountainous regions, but unfortunately does not occur in Missouri.

SCARLET OAK IN MISSOURI

JULIAN A. STEYERMARK

Among the most brilliantly colored trees in the Missouri forests in the autumn are the oaks, and one of the reddest oaks to be found in the state is the Scarlet Oak *(Quercus coccinea)*. Only the Sour Gum or Tupelo *(Nyssa sylvatica)* and the Red Maple *(Acer rubrum)* rival it for intensity and brilliance of the red coloring. The Sour Gum starts turning to deep reds and scarlets late in summer and has lost most of its leaves by middle to late autumn; while it is in late autumn, from the middle of October to the first of November, that the Scarlet Oak is the most spectacular. It starts turning slowly. When the flowering dogwood, ash, maple, hickory, sassafras, and haws are flaunting their gaudy colors, the Scarlet Oak is mostly green with only a suggestion of the gorgeous red that is to follow. Then, when the colors of the other woody species have begun to fade and the leaves have begun to fall from the Sour Gum, hickory, walnut, butternut, and persimmon, the Scarlet Oak bursts forth with the deepest red imaginable.

The Scarlet Oak is one of the stateliest species of the Black Oak group. In Missouri it occurs in acid soils associated with sandstone, chert, or granite rocks, on narrow ridges, ravine slopes, and upland woods, often bordering headwaters of tributaries. It is usually found associated with other oaks,

Scarlet Oak *(Quercus coccinea)*

particularly White Oak, Northern Red Oak, Black Oak, various hickories, and often Southern Yellow Pine. At one time it was thought to be very rare in the state. However, with more detailed exploration of the Ozark forests, it has been found in the various southeastern Ozark counties, bordered on the north by Ste. Genevieve, St. Francois, Washington, and Crawford counties, on the west by Dent, Texas, Douglas, and Howell counties,

and on the south and southeast by Scott, Bollinger, Wayne, Butler, Dunklin, Ripley, and Oregon counties. Its southwesternmost stations are in the sandstone hills of eastern Douglas County following the drainage of Indian Creek, northeast and south of Topaz.

In mature trees the trunk bark of the Scarlet Oak is similar to that of the Northern Red Oak *(Quercus borealis* var. *maxima)*, with large sections of light gray or gray-brown smooth surfaces broken by darker shallow vertical grooves. The conspicuous acorn cup is strongly convex on the bottom, covers about half of the nut, and is composed of glossy, closely set, rather than loose, scales, which are glabrous or nearly so. The winter buds are glabrous in the lower half and pubescent in the upper; they are smaller and much less pubescent than in the Black Oak and more pubescent than in the Northern Red Oak or Shumard or Schneck Oak. The leaves are grass-green on both sides, much thinner than in the Black or Shumard Oaks, as deeply cut as the Pin, Jack, or Shumard Oaks, but more deeply cut than either the Black or Northern Red Oaks. The upper leaf surface is not lustrous as in the Black or Shumard Oaks. The axillary tufts of hair on the lower leaf surface, so conspicuous in Shumard and Black Oaks, are mostly lacking or inconspicuous in the Scarlet Oak.

The Scarlet Oak is fairly widely distributed in the eastern United States from Maine to North Carolina, where it is common in the Great Smoky and Blue Ridge mountains, and reaches its southwestern limits in southwestern Missouri and adjacent Arkansas. It has been previously confused with the Jack or Hill Oak *(Q. ellipsoidalis)* in the Driftless Area of northern Illinois, southern Wisconsin, southern Minnesota, northeastern Iowa, and one county in northernmost Missouri. Some northern Indiana material previously considered to be *Q. coccinea* is now believed to be *Q. ellipsoidalis*.

THE NUT TREES

AUGUST P. BEILMANN

A quick glance along the shelves of any large food store will show how important nuts have become in our modern diet. Not many years ago only country folks had nut meats after the winter season, and city children knew them only as holiday confections. Of course, peanuts had a longer season (one could find them even during the summer at picnics), but the shelled meats of walnuts, pecans, almonds, and hazelnuts were available for only a short while after harvest. Chestnuts, of course, could be obtained from vendors in many large cities, but the chestnut blight, which has destroyed the mature trees, has now completely removed them from the scene. The food value of most nuts is high, and the many ways in which they are pre-

pared and preserved for year-round marketing have made them an article used for culinary purposes almost daily.

In 1890 the pomologist Van Deman circularized the nut-growers and the information thus obtained appeared in a publication of the U. S. Department of Agriculture, entitled "Nut Growing in the United States." There it was pointed out that the growing of nut-bearing trees had been confined to very narrow limits in both area and varieties, which might be due to the impression that "the man who plants nut trees does so for his successors rather than for himself." It seems strange that young men seldom plant a nut orchard, and that the most enthusiastic nut growers are always older men who may or may not have the twenty-five years to wait for the first crop.

Hazelnuts are the only nuts in this area which grow on a fence-row shrub, walnuts, pecans, and hickory nuts all being produced on mature trees. Walnuts, hickories, pecans, hazelnuts and the hybrid-chestnuts have proven hardy here and capable of producing an annual crop. The walnut is certainly the most dependable, and many good varieties can be obtained from the nurseries.

About fifteen years ago a nut orchard was planted on a sandy bench along Brush Creek in the Arboretum. Since fashions in walnut varieties change rather slowly (a quarter century being required to determine the value of any selection or hybrid), two old standard varieties were used—THOMAS and STABLER. However, twenty more might be added to the list if a new planting were contemplated. Later a few of the newer varieties were budded on seedlings. Great emphasis was placed on pecans, and the eight following varieties were used: WARWICK, KENTUCKY, MCALLISTER, BUSSERON, MAJOR, GREEN RIVER, POSEY, and BUTTERICK. These varieties have justified their selection in so far as vigorous growth and winter hardiness are concerned, but the amount of nuts produced is unknown since the squirrels normally harvest the entire crop. A few trees of Jujube were added to this planting, and these have done well enough to produce some fruit. Some hybrid chestnuts were planted near this grove and have produced sizeable quantities of fruit.

The cultural requirements of any nut tree are rather exacting. Walnuts are quite generally distributed on the better soils over eastern Missouri. To grow well, a walnut must have a very fertile soil of sufficient depth to hold ample moisture. They will not grow on a hot, dry hillside, nor on locations where erosion has been serious. If they are to be grown as an orchard tree they should be spaced at least forty feet apart. Even then the branches will touch at the end of twenty years, and maintenance as well as harvesting may become something of a problem.

The hickories can be found in almost every wood-lot in the state. The

nuts of a great many species are hardly worth gathering, but often certain specimens have something of a local reputation as producers of good nuts. Only a limited amount of work has been done with the hickories. Although twelve varieties of Shagbark Hickories were known in 1895, all of these were from the northern states where lack of winter hardiness precludes the planting of pecans.

The pecan, of course, has been the subject of more investigation and experimentation than any other nut tree. The industry was very well established as early as 1895, when orchards of 400 acres were in existence along the Texas coast. Some very large native pecans can be found in the floodplains of the Missouri and Mississippi rivers considerably west and north of St. Louis. Often the nuts of these wild trees are gathered and sold locally. A great many of them are of good quality but lack the size and the cracking quality of the thin-shelled pecans of the South. Pecans will not do well on a thin soil, nor one lacking in fertility or moisture. They will grow in the black gumbo along the big rivers and the black cotton land in the South.

The hazelnuts or filberts are almost limited to the several native species, but modern agriculture has almost eliminated them from our fence rows. This is the only nut tree which could be grown in a small garden. Most of the breeding or selecting for new varieties involves the European Hazelnut, but it appears nearly impossible to find some of the better European varieties. Since the plant normally grows in a fence row, where the build-up of humus reaches a peak, it follows that it can not be expected to grow well unless considerable depth of good, well-drained soil is available. Many of the named European varieties have been tried at the Arboretum. Little is known about the nuts since the squirrels begin harvesting long before the fruit matures.

Since the loss of the American Chestnut a great deal of work has been done to find disease-resistant strains and to import other species with the expectation of producing superior highly resistant hybrids. While many of the selections and hybrids have proven satisfactory, none have the quality of the American Chestnut. The Chinese Chestnut has been widely planted and usually begins to bear fruit when fifteen years old. At this time it still resembles a shrub rather than a tree, and if widely spaced, as would be done in orchard planting, the plants require considerable pruning to force them into tree-like growth. The chestnut has one advantage not enjoyed by any other nut—the burs are so spiny that they are free from squirrel attack. Considerable interest was shown in the chestnut as indicated by the seventeen varieties known in 1895. However, the chestnut blight had become well established in the South at that time and interest in the crop declined.

There are a few other trees whose fruit might be included in a list of nut trees. The Maidenhair Tree (Gingko) produces a large fruit in a very ill-

smelling, fleshy cover, but these have not been used except in the Orient. The Jujube has grown well and produced some fruit, but this, too, is a fruit used only in the Orient. Several plants of pistachio have proven winter-hardy but have never fruited. Commercial supplies of this usually come from the Mediterranean region.

Planting and care.—A number of northern nurseries can furnish varieties of nut trees. Ordinarily the planter can expect considerable mortality when setting out these young trees. Even though seedling walnuts and hickories may be found in almost every part of the contemplated orchard, it does not follow that a named variety will transplant readily. Sometimes three or more seeds are planted in a group with the hope that one will succeed and grow into a tree. Seeds gathered locally can be planted in this manner with the expectation of budding a named variety into the top during the third year. This practice has been successfully carried out by Mr. John Howe, of Pacific, and it has also been extensively used at the Arboretum. Mr. Howe has budded some very large walnuts, working from a twenty-foot ladder. Even this method is not fool-proof where there are many field mice or squirrels. Sometimes the individual seeds are planted in place in tin cans with a hole through the top and the bottom removed so that both stem and root can emerge before either mice or squirrels find the nut. Unfortunately, these elaborate precautions are not enough to establish seedlings in a neighborhood with a high rodent-population.

After the trees are several years old they must be given periodic care. Some pruning will be needed to avoid the formation of a forked trunk. Fertilization and mulching will be of great help during the first years and a vital necessity when the trees reach bearing age. Spraying must be done throughout the life of the tree to protect the foliage in youth and the crop in later years. In eastern Missouri the nut trees are not attacked by as many insects or diseases. The walnut datana is the most troublesome, but this caterpillar can be readily controlled through the use of arsenicals. Twig girdlers prove a nuisance in some years, and because of the difficulty of reaching the larvae with sprays it may be necessary to change the cultural practices. Of course, all the maturing fruit have special insect enemies, but these can be controlled through spraying and further cultural practices. Leaf rusts and a host of other fungi may attack the trees in the orchard as well as the related species in the near-by woodlots. Normally, these diseases would prove to be no obstacle in the growing of selected varieties of nut trees, and ordinarily in this area no special difficulties need be anticipated.

Growing the better varieties of nut trees is quite a horticultural challenge. Usually many years must elapse before a small crop is produced. In areas where nut growing is not an established business it may be difficult to find a market.

THE BULL BAY MAGNOLIA IN ST. LOUIS

AUGUST P. BEILMANN

St. Louis is not quite far enough south to grow many of the spectacular southern trees. On the other hand, it is a little too far south for a number of the northern conifers. Thus the criterion of a good gardener here may resolve itself into an inventory of the species which he is able to grow. A well-grown Bull Bay Magnolia *(Magnolia grandiflora)*, so famous in song

Leaves of Bull Bay Magnolia

and story, would certainly entitle the gardener to an "expert" rating. It is a common door-yard tree in Charleston, Mo., does fairly well at Ste. Genevieve, but can be grown only under the most fortunate circumstances in St. Louis.

Plants brought so far from their natural range often fail because they lack hardiness. One plant may be winter-hardy, i. e. capable of standing low temperatures and hard freezes, while another may be unable to stand the heat and low humidity of our summers. Both plants die, and too often they are dead by the coming spring. This makes it quite difficult to determine

the exact part of the year during which the plant failed. In either case, it is a desiccation process, a drying-out by freezing, or a rapid evaporation during extreme heat. Either condition can be aggravated by too much exposure to wind or to sunshine. It is probably the desiccation following freezing, aided by wind, and aggravated by too much sunshine which causes the death of *Magnolia grandiflora*. The immense leaves are using water at a rapid rate when exposed to brilliant sunshine. If most of the plant is frozen during a cold snap there is no replacement of moisture, and this results in dehydration which becomes evident in the browning of the leaves and small branches. The Bull Bay Magnolia appears to be hardy if given a degree of protection from winter winds and if it is planted away from the maximum exposure to winter sunshine.

Young Bull Bay Magnolia in the nursery area at the Arboretum

Bull Bay Magnolia seedlings in the Arboretum nursery

The Bull Bay Magnolia has been grown successfully in the St. Louis area. Mr. Walker Hill has a number of flowering specimens at his home in University City. Seeds from these trees have been planted at the Arboretum. As early as 1891 Mr. Leonard Matthews, of St. Louis, began to grow this magnolia. In 1922, he presented the Garden with a 20-foot specimen which had survived without injury from his first planting. This tree (see March, 1922, Garden BULLETIN) lived for another ten years after being moved to the Garden, and died without ever showing a trace of winter tenderness. An older specimen (see illustrations) has been growing alongside a steam tunnel in the Garden for well over a quarter of a century; and a number of seedlings showing outstanding hardiness have been grown at the Arboretum from a seed source in North Carolina.

If we bear in mind certain basic requirements it may be possible to grow this magnolia in St. Louis. First, it must not dry out during any part of the year. One of the best means of maintaining uniform soil moisture is a heavy mulch of rotted manure. Second, the tree should not be exposed to the full winter sun; plant it on the north side of a building if possible. Third, it must be protected from the strongest winds in winter as well as summer. However, not all seedlings brought from the South will behave alike, and it would be best to obtain plants from as far north as possible on the assumption that these will show some degree of adaptability. Nearly all magnolias transplant best in late spring after growth starts, and this holds

A Bull Bay Magnolia at the Garden as it appears in summer (left, seen from the south), and in winter (right, seen from the north).

for the Bull Bay Magnolia. Very few specimens survive a St. Louis winter without some leaf damage, but if the damage is not too severe the tree usually recovers and continues to grow. However, we cannot expect that a tree showing a considerable annual damage in our area will ever rival the specimens growing in the South.

NOTES

The annual chrysanthemum show at the Garden will be open to the public on Sunday, November 5.

The dahlia show of the Greater St. Louis Dahlia Society was staged in the Floral Display House at the Garden on October 1, and the cactus show of the Henry Shaw Cactus Society, on October 8.

Mr. Maong Tin, economic botanist of the Government of Burma, Mandalay, is registered as a graduate student in the Henry Shaw School of Botany of Washington University, to study at the Garden.

The members of the National Council of State Garden Clubs, meeting in St. Louis, October 11--12, were guests of the Garden on October 11, and after a tour of the grounds were served tea in the Museum building.

Recent visitors to the Garden include Dr. Ethel T. Eltinge, who received her doctor's degree from the Henry Shaw School of Botany and is now on sabbatical leave from Mt. Holyoke College, South Hadley, Mass.

Mr. George H. Pring, Superintendent of the Garden, was recently elected president of the Kew Guild (alumni of the Royal Botanic Gardens, Kew, England). He is the first American to have this honor.

Dr. Henry N. Andrews, Paleobotanist to the Garden, Dr. G. A. L. Mehlquist, Research Horticulturist, and Dr. Sergius H. Mamay, who received his doctor's degree from the Shaw School of Botany in June, attended the meetings of the Seventh International Botanical Congress, held in Stockholm, Sweden, July 12 -20. Dr. Mehlquist also attended the pre-congress genetics meetings at Lund, Sweden, July 6 -10, and during August and September visited botanical and horticultural institutions in Sweden and Denmark.

The third number of Volume XXXVII of the ANNALS OF THE MISSOURI BOTANICAL GARDEN was issued during the month, containing the following papers: The American Species of *Triumfetta* L., by Ko Ko Lay; Miscellanea Taxonomica, I, by Robert E. Woodson, Robert W. Schery, and George B. Van Schaack; Some American Carboniferous Fern Fructifications, by Sergius H. Mamay.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 50,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until 7:00 p. m.; Sundays, 10:00 a. m. until 7:00 p. m. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah bus line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

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MISSOURI BOTANICAL GARDEN BULLETIN

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Cover: Shadows on the new pergola of the Italian Garden.
Photograph by Ladislaus Cutak.

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Missouri Botanical Garden Bulletin

Vol. XXXVIII NOVEMBER, 1950 No. 9

THE BEE IN BOTANY

AUGUST P. BEILMANN

Long before the time of Linnaeus, the founder of the present system of plant classification, botanists were interested in the uses of plants and every plant that had even local value was given some kind of a name. Eventually, attention became attracted to the distribution of plants, their relationship to one another, and their preferences for soils, sites, and exposures. This led to even greater botanical specialization, and there are today societies devoted to ferns, to wild flowers in general, and to each and every group of ornamental plants.

Those interested in the wild flowers are likely to attach much importance to soil conditions, seasonal rainfall, exposure, and all the other factors which are part of the environment. Most of the wild flowers have their cyclic ups and downs. An abundance of wild flowers is often attributed to ample rain, but the same amount of rain a little earlier in the season during another year might stimulate competitors at their expense. Plant populations may also decline because of a series of unfavorable years. Usually we think of these variations in populations as due largely to the weather, and the fact that complete pollination is needed to produce an adequate seed crop, especially for the annuals, is rarely given consideration.

Most plantsmen have an academic knowledge of the bee as a pollinator, but relatively few fully appreciate the close connection between these insects and a good crop of seed for the coming year. The great importance of the bee has recently been given attention by the Department of Agriculture in the seemingly simple problem of producing increased quantities of legume seeds. It has been pointed out that the bee is of far greater value as a pollinator than as a producer of honey and wax. In the program to increase seed production it has been proposed that the beekeeper be granted aid from the federal government. That equal importance should be attached to the bees' activities in relation to the wild flowers is not at all appreciated.

The practical result of bee pollination can be observed in Hidden Valley and also at the Arboretum. Hidden Valley is noted for its mass display of many of the uncommon wild flowers. In addition to the soil, exposure, and all the other factors which have a bearing on wild flowers, one unusual feature of this tract has always been the presence of many domestic bees. Beginning with the earliest plants to bloom such as the False Rue Anemone (*Isopyrum biternatum*) and continuing on to the Goldenrod (*Solidago* sp.) and Asters (*Aster* sp.), every flower which yielded either nectar or pollen was visited by the bees. In the absence of any bee yards in close proximity to the tract it was difficult to account for the numerous bees in the area. During the course of the logging operation the reason became quite apparent: it was the number of bee trees. Due to the great size of the trees in the tract and the limited time available it was not possible then to learn the exact number of bee trees, but during the winter enough evidence was found to indicate that escaped colonies had established their hives in at least twelve trees, or about one to every twelve acres.

A portable pollinating unit at the Arboretum

The excellence of the wild flowers in Hidden Valley can not be charged to the efficiency of the bees alone. The site, the fertility of the soil, and the fact that there has been no disturbance all contribute to the spread and wonderful floral display. However, if all the pollinators were taken from the area a great many species would decline, if not disappear.

In the Arboretum a demonstration of the same sort has been observed during the last eight years by the maintenance of a sixteen-colony bee yard. Perhaps a word of explanation is needed. A bee tree is one having a hollow pocket in the trunk or branch large enough to accommodate a swarm and the combs they build during the succeeding years. A perfectly sound tree,

no matter how large, offers no suitable housing. Much of the timber in the Arboretum is too small and most of it too sound to be of any value for this purpose. Normally, only three or four bee trees can be found on the entire 1600 acres at any given time, and it became necessary to maintain a bee yard using the standard commercial hives. When the bees were first brought to the Arboretum, White Clover *(Trifolium repens)* was a rare plant confined to the new road shoulders. Miami Mist *(Phacelia* sp.*)* was represented by only several small colonies a yard or so in diameter. During some years Spring Beauty *(Claytonia* sp.*)* seemed to be declining, but this was partly attributed to the greater duff cover on the slopes where it grew. Likewise, the rise and fall of certain other wild flowers had been credited to unseasonable weather. That the bee played a part in this annual display is becoming more evident each year. For instance, the clovers are now widely distributed; Miami Mist patches cover thousands of square feet; and the number of bees visiting Spring Beauty has apparently aided its spread and reseeding. This does not mean that bees are solely responsible for the wide distribution of clover or any other plant, but it does mean that they are responsible for adequate seed production. This in turn allows a plant to perpetuate itself and to spread to adjoining areas.

The actual agency responsible for distribution of the seed might be difficult to determine. Cattle certainly spread clover; birds are fond of other seeds; and the wind, rain and all other agencies have a hand in moving the seeds to a new site. However, without good seed production an annual will quickly decline and may even disappear. Even perennial plants do not live forever and reseeding is the only way in which they can be perpetuated. A plant can increase its range only when some agency carries the seed to a new location.

The pollination problem when applied to wild flowers, and even many forest trees, appears quite complex, and assumes some of the characteristics of a circle. There are many gaps in our knowledge but without adequate seed production the wild flowers disappear. Modern agriculture and logging have so complicated the situation that there are fewer and fewer bee trees and less and less ground space for the bumble-bee and the other native pollinators. Most of the wild flowers must be insect-pollinated, but the flower nectar must contain over 15 per cent of sugar to be attractive to bees. To maintain the proper sugar-content, the plants require a fertile soil, and if the fertility level drops, there will usually be no set of good seed. A rise in the fertility level favors the production of an attractive nectar, and this in turn insures good seed. Thus the wild flower, instead of disappearing, will increase annually.

The period between 1875 and 1914 has been called the "Golden Age of Beekeeping." During these years almost every farm had a few hives; this was also the time when the modern hive began to replace simpler and less efficient equipment. With such uniform distribution of pollinators—and perhaps a higher fertility level—there was no serious shortage of good seeds. It seems likely that the coming decade might very well be called the "Age of the Pollinator." It appears that the presence or absence of bees should be added to the list of variables affecting the rise and fall of wild flowers. Even a redbud will not set seeds except when close to a colony of bees. In fact, the number of seed-pods on a redbud is a pretty good indication of the number of pollinators in the immediate vicinity.

CHLORDANE VS. ANTS

LADISLAUS CUTAK

Are you troubled with ants? Why not give Chlordane a try? This relatively new insecticide has proven by far the most effective weapon for the control of these insects in the greenhouses at the Garden. Ants are apt to be pestiferous and annoying wherever they occur but are perhaps at their worst in the greenhouse. There they indirectly cause damage to ornamental plants by spreading aphids, mealy-bugs, and scales—the actual culprits.

Aphids, mealy-bugs, and scales are sucking insects. They imbed their long "beaks" in plant tissues and extract the juices, causing discoloration, injury, and perhaps eventual death of the plants. These insects secrete large amounts of "honeydew," which serves as a growth medium for molds and other fungus diseases. The honeydew also attracts ants which, finding that

Fig. 1. Showing colony of ants wiped out by use of chlordane.

plant lice and mealy-bugs offer a constant source of delectable food, tend these pests and guard them from enemies. Ants also transport "bugs" to other plants and spread the infestation.

Contact sprays, stomach poisons, and fumigants of various kinds have been used to combat ants in the greenhouse with only moderate success. Periodically syrup impregnated with arsenical poison was set out in ant roadways, and nicotine and cyanide sprays were also used. Such treatment killed those ants that came in contact with the insecticides, but others remained to multiply and to offer a continuous and costly problem. Finally, Chlordane was used, and a single application gave effective control for several days. Since it has been in constant use the ant invasions in the greenhouse have been reduced considerably.

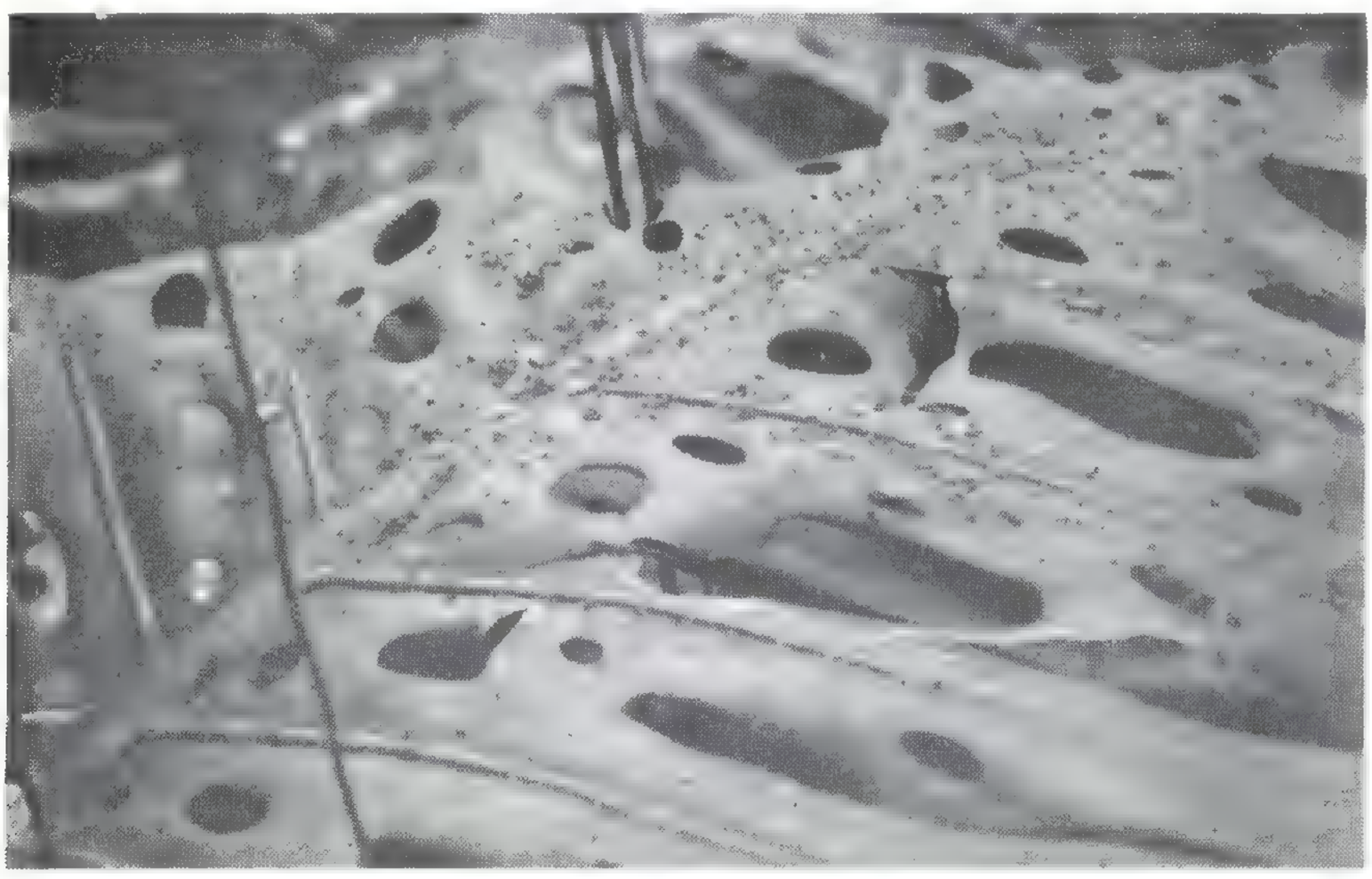

Fig. 2. *Monstera deliciosa* leaf covered with dead ants.

Chlordane may be purchased from any of the larger seed houses under various trade names such as Dow-Klor, Syn-Klor, Toxi-Chlor, etc. In the main greenhouse ranges we have been using Dow-Klor—40 per cent wettable put out by the Dow Chemical Co., Midland, Mich. Although it is claimed that this powder can be readily dissolved in water, to make a residual spray we have usually used it in dust form. Our compounding calls for one part of Dow-Klor to two parts of talc. The mixture is sprinkled in areas frequented by ants, particularly near cracks, bases of plants, or wherever the insects emerge.

Chlordane appears to have a three-way action against insects. It serves as either contact or stomach poison, and it gives off lethal fumes. A little of the powder placed at the base of a tree, vine support, or walls where ants are parading will cause them to drop without their even appearing to touch

the poison. When Chlordane is sprinkled on ant trains the insects are immediately paralyzed on walking through the powder. Soon whole colonies are wiped out (fig. 1). Fig. 2 shows a *Monstera deliciosa* leaf covered with dead ants which had fallen from a Cissus vine overhead. Chlordane seems to be as effective a control against cockroaches and other insect pests as it is against ants.

HARDINESS OF MAGNOLIA GRANDIFLORA IN THE ST. LOUIS AREA

GEORGE H. PRING

The article on the Bull Bay *(Magnolia grandiflora)* in the October BULLETIN brought up again the question as to its hardiness and has led to a search for large Bull Bay trees in the St. Louis area.

The oldest specimen is undoubtedly the one in the Garden south of Henry Shaw's residence. To the writer's knowledge the tree was already growing there in 1906, at which time it was about 10 or 12 feet high. No record exists of its origin, but it probably was shipped from a southern nursery. This specimen is protected on the north by the Old Residence, on the east by a greenhouse, on the west by a good windbreak, but is open to the south. During the past twenty years it has had no special protection but in spite of this no serious winter damage has been noted. At the present time the tree is approximately 28 feet tall, with three major trunks, each about 8 inches in diameter 1 foot from the ground. There is a smaller leader about 3 inches in diameter. For the last ten years this tree has produced many flowers and seeds.

In 1913 twelve plants of *Magnolia grandiflora* averaging 10 feet in height were purchased from a Florida nursery, and planted in the main plaza at the Garden. Despite the fact that they all had winter protection every tree died during the following winter. However, at that time a hardy specimen of the Bull Bay had been growing in the St. Louis garden of the late Leonard Matthews for many years. The following account of it is from the March 1922 BULLETIN:

> In 1891 Mr. Leonard Matthews purchased 50 plants of *M. grandiflora* from a southern nurseryman and planted them all in selected places in his garden. The young trees became established, but with the advent of winter all froze the first winter and subsequently died except one specimen which was planted in a somewhat secluded position, protected on the north by residences and on the west by a spacious garage, which, no doubt, accounts for its having survived the severity of our winters. It is conical in shape, 20 feet high, with a well-developed trunk measuring 1 foot in diameter at the base.

In 1922 Mr. Matthews presented this specimen to the Garden where it was planted in front of the Cycad House. Although every precaution was

Magnolia grandiflora south of Old Residence at the Garden—the oldest specimen in this area.

Twelve-foot specimen north of Main Gate, grown from seed obtained from tree at left.

taken as to its care the tree died within three years.

In 1940 an experiment was undertaken at the Garden in order to establish the hardiness of *Magnolia grandiflora* when grown from seed collected in this region. Twelve trees grown from seed obtained from the tree near the Old Residence were planted in the exposed nursery in the North American Tract and given no winter protection. These seedlings all grew well and suffered no winter damage except loss of foliage and minor twig injury due to ice storms in March. In 1946 two 5-foot plants from this lot were removed to a location just inside the Garden at the main entrance. Both have become established, but the specimen to the north of the Main Gate (see illustration), has more than doubled in height during the past four years. Smaller specimens were planted in the Linnean Garden where they are doing well.

Attention was called in the April 1947 BULLETIN to the fine specimen of *Magnolia grandiflora* var. *lanceolata* growing in the front lawn of Mrs. Paul Brown's residence, 5855 Lindell Boulevard. It is sheltered by the house, about 10 feet northwest of it, as well as by a windbreak of large trees. The tree was obtained from a Georgia nursery in about 1934, at which time it

Magnolia grandiflora at Mrs. Paul Brown's residence, on Lindell Boulevard.

was not over 5 feet high. It is now 20 feet high, with a single trunk about 10 inches in diameter. For several years the tree was protected during the winter by a cloth-covered wooden frame, but after that it received no protection of any kind. It has flowered for the past five or six years, producing abundant seed. This tree has the characteristic larger leaves and internodes of the variety *lanceolata*.

Several specimens of *Magnolia grandiflora* are growing in the area of Collinsville, Illinois, having been imported from Florida in 1936 by the H. C. Schnell Nursery, of Collinsville. One of these is in front of the Evergreen Gardens on Highway 40. At the time of planting, twelve years ago, it was about 5 feet tall and is now 20 feet tall with a single trunk. The tree faces south and has the protection of the building on the north. Two

Magnolia grandiflora at Evergreen Gardens, on Highway 40, near Collinsville, Ill.

Magnolia grandiflora in front lawn of Campbell residence, Collinsville, Ill.

other Schnell specimens were planted in the R. F. Campbell lawn, at 102 Mesa Drive, Collinsville. The one on the west side of the house is exposed to the north and shows the effect of winter damage, but the one on the south side is a perfect specimen with a double trunk 8–9 inches in diameter one foot from the ground. When planted in this location they were about 5 feet high. There remain in the old Schnell Nursery (now Pring's Nursery) three of the original specimens which have been, and still are, used primarily as a seed source. They are well protected by other trees but exhibit multiple trunks which may indicate either freezing back or past cutting of branches

for decorations. They have been seeding for the last seven or eight years, and up to 100 of their seedlings are growing in the nursery, varying in size from 1 foot to 10 feet. The young plants in the nursery show characteristic rapid growth of 18–24 inches annually. They are very similar in appearance and behavior to the plants grown in the Garden just west of the Main Gate.

From the above instances it would appear that *Magnolia grandiflora* may be hardy in the St. Louis area, particularly when propagated from plants grown in this section and given some protection on the north. When specimens are brought in from the South one must expect a loss. Winter damage to leaves and twigs may occur when the plants are young or during ice storms, but the very rapid growth and recovery of the plants more than compensates for this.

Recent studies seem to indicate that the climate of the United States is changing rapidly. In effect, the whole country is "shifting southward," so that New Orleans is acquiring the climate of Yucatan and Montreal the climate of New York. The last several years in St. Louis would seem to substantiate this. We are all familiar with grandfather's saying that, "the winters aren't like they used to be when I was a boy." And he is right—as the weather record will testify. This autumn has been one of the warmest (and driest) within memory. It has caused some "confusion" among plants, just as did the very early spring of 1946. Normally, the oaks are about the last of the trees to color, while the Silver Maples, Chinese Elms, and mulberries are quick to shed. This year most of the oaks had browned (at about their usual period), but the prolonged warm weather has kept the Silver Maples and other trees green and in partial foliage into the second week of November. Many plants that are normally spring-blooming are blooming again this autumn. We have all read in the newspaper about strawberries being harvested within the last few weeks, but many other plants as well have bloomed "a season ahead." Annual Bluegrass *(Poa annua)*, and Orchard Grass *(Dactylis glomerata)*, and the common lawn chickweed are among them. Of course, cursory flowering of shrubs may occur in any delayed autumn, but it has been even more apparent this year. Yes, the seasons of 1949 and 1950 compared to those of the 1930's, and now one of the warmest of St. Louis autumns, might well convince us that climatic changes certainly aren't slow in coming. Maybe in a few years St. Louis will have *Magnolia grandiflora* and azaleas as they are grown in the South, and blue grass lawns as they have been grown in the North? Meanwhile we can't complain.

[R.W.S.]

Sasa palmata in the Economic Garden

A HARDY JAPANESE BAMBOO *(SASA PALMATA)*

GEORGE H. PRING

Sasa palmata, which has been in cultivation at the Garden and Tower Grove Park for the past forty years, is one of the handsomest of the medium-low Japanese bamboos. The culms or shoots grow up to six feet in this locality. The primary branch arises singly from some of the middle and upper nodes of the culm and later a secondary branch often grows from the base of the primary. The leaves are bright green above and somewhat lighter or glaucous on the under side. They are borne in palmate clusters and are about the largest of the bamboos, often being 12–15 inches long and $2\frac{1}{2}$ inches wide. The prominent secondary veins, 8–12 on each side of the mid-vein, are another attractive feature of the leaves.

Large clumps of *Sasa palmata* are growing on the west side of the walk in the Economic Garden, and in Tower Grove Park plantings may be seen

around the lily pools. This bamboo is good for mass plantings and deserves a place in city gardens. It is neat in habit and free of hairiness. According to Robert Young (*National Horticultural Magazine*, July, 1945), the identity of this plant has been very much confused. *Sasa palmata* E. G. Camus is now the correct name, but it has been known under the following names: *Bambusa palmata*, *Arundinaria palmata*, *A. paniculata* forma "chimakizaza," *Sasa paniculata*, and *S. australis*.

Nymphaea "Joe Cutak"

NYMPHAEA "JOE CUTAK"

GEORGE H. PRING

This hybrid Nymphaea originated from the same seed-pod as *Nymphaea* "Bob Trickett," described in the November 1948 Garden BULLETIN, the parents being *N. stellata* var. *coerulea* and *N.* "Mrs. Edwards Whitaker." However, it differs from "Bob Trickett" in dark blue flowers and the prominent red flecking of its leaves. It is an excellent grower and good propagator.

It is named in honor of the late Mr. Joseph Cutak, who had charge of the water-lily department at the Garden for many years.

Description.—Flowers 8–10 inches across; bud ovoid, dark green densely lined with purple; peduncle greenish-brown; sepals and petals hooded at the apex, Chicory Blue*, green towards the base within, the outside dark green prominently lined with purple; sepals 4, about 4½ inches long, 2 inches wide; petals 35–40, the outermost row about 4¼ inches long, 1¼ inches wide, peduncle greenish-brown; stamens 240–245, Lemon Chrome tipped with Chicory Blue; carpels 30–35, Light Cadmium; leaves suborbicular, 14 inches long, 13 inches wide, margins undulated, above dark green flecked reddish-brown, fading with age, on the under-side red with green venation, lobes overlapping, with age pushing up; petioles greenish-brown.

* Color terms in capital letters are those of Ridgway's "Color Standards and Color Nomenclature."

CROW SHOOTING

AUGUST P. BEILMANN

Sporting magazines have often urged the sportsman to keep his co-ordination of eye and hand properly tuned for the hunting season by using the crow as a target throughout the year. The crow is held up as a black rascal whose character is unrelieved by a single good trait. Since he is charged with the destruction of eggs and nestlings of song and game birds, a degree of control would result in an increase of other birds. The condemnation of any species is probably not entirely justified; and a careful study would uncover a few commendable traits. The good points of the crow are that he eats insects and crustaceans and that he is an effective scavenger. Thus while not completely black in character, he is nevertheless a wily bird capable of making a living almost anywhere and off almost any organic material. He is often more than a nuisance when he raids a newly planted field to pull up sprouting seed, or silently hunts through the woods and fields to rob nests and kill nestlings. Quail nests are a favorite source of food and he has been observed carrying away the eggs of the Mallard Duck. Lately crows have begun to roost in the Pinetum during the coldest and windiest winter nights. Here they bend and break the leaders of the evergreens and cause a malformed shoot which never grows straight.

In the general scheme of things only the most efficient and adaptable species survive. The crow, like the English Sparrow and the starling, has demonstrated his versatility and his ability to make a living almost anywhere. He appears to have only two natural checks—the hawks and the

owls, so he lives a rather carefree existence provided he learns the exact range of the modern shotgun. Certainly many crows are killed by hunters out after other game; few duck hunters can pass up a chance to shoot at a crow. Many individual birds are killed at long ranges with a "Varmint" rifle, scope mounted and firing an ultra-high speed bullet with a flat trajectory. But this and even the dynamiting of the roosts, in which thousands of birds are killed, serves only as a temporary check to the population.

The crow has demonstrated his right to live in this area—if a certain discreditable wiliness is a mark of adaptability. He is a worthy foe if hunted with a shotgun where an ability to "call" and a knowledge of woodcraft is required. Actually the crow has superior vision, and usually if the hunter can see the crow it is a foregone conclusion that the crow has seen the hunter. In fact, it appears that he can count to five; that at least seven men must approach a blind and five must return to drive away if any birds are to be lured to this blind by "calling." And it is not hard to believe that crows can recognize the make and caliber of a gun and thus protect themselves by remaining outside the effective range. Certainly old crows which have lost some feathers when responding to a "call" are more difficult to bring within effective range the next time. And it is sometimes necessary to throw a charge of shot in their direction to keep them from drawing off those birds ready and willing to do battle where the caller is stationed. These wiser birds usually circle about well out of range, ready to sound an alarm if the caller makes a false move.

There is another way to shoot crows, and no "calling" is necessary. The action is fast and furious while it lasts and it takes advantage of the roosting habit of the bird. Crows usually gather together daily—some time before roosting—and indulge in a raucous cawing during which all the happenings of the day are recounted amid cheers and jeers. Observers have said that it is during these gatherings that infractions of crow law are reported and punishment is meted out. At least, it is not unusual to observe an individual being driven from the roost amid the wild cawing of all the other birds. Before a roosting site is settled on, several individuals "scout" the area, even though the spot has been used nightly for weeks and months. The scouts proceed about their job rather quietly at first and seldom begin cawing until satisfied that no danger exists. Once the site has been selected (usually a stag-headed tree) other birds join them, and the flying and calling continue until just before dark. Suddenly it eases and no noise is made until they leave the roost in the morning.

Some of the most sporting pass shooting can be had at such a roost, but the hunter must study the flight habit of the birds using that roost just as thoroughly as the birds did before accepting it as a safe haven for the night.

All the crows within the radius of many miles use one roost; to reach this they fly along definite routes and if not frightened they proceed along the same path nightly. They can be intercepted along the route—about two hundred yards from the roost—if the sentinels are not disturbed and provided the hunter does not miss any birds. The alarmed cawing of a missed bird that has had a glimpse of the gunner will abruptly end the proceedings. Neither the noise of the gun nor the collapse of a bird in full flight will alarm the roost—but don't miss a bird! In flying to the selected tree, crows appear to follow a path as clearly outlined to them as the approach to the most modern air-field. Generally the birds fly singly, often spaced several minutes apart, confidently flying on the "beam" regardless of how many birds have suddenly fallen to the gun. But if a bird is missed and frightened, the "beam" is instantly dangerous and the incoming birds select a new route. For this form of hunting the hunter requires complete concealment with a somewhat clear opening overhead through which to shoot and enough opening ahead to spot the birds before they arrive. A dense growth of small elms or a sumac thicket serves very well. No attempt has been made to shoot from a blind constructed for the purpose; the crow takes very few chances and any change about the roost may cause the birds to abandon the location. It must be remembered that the "scouts" have examined the area as early as three o'clock, and although no attempt to roost will be made for another three hours, the area will be checked and re-checked several times beforé settling down.

The crow considers all owls and hawks as blood enemies. A crow will always attack and deliriously call for his neighbors to help drive an owl to cover. This habit has been taken advantage of by hunters, and molded owls having "two faces" are sometimes placed where a crow may be "called" to do battle. However, the method has not worked at the Arboretum; apparently it is a special technique and requires special study. It may be most effective during and immediately after the nesting period when the adult crows are teaching the young to fly and scrounge. That crows have good reason to mistrust owls is amply demonstrated by the observation of Brother Lewis, of the La Salle Institute, Glencoe, Mo. In a survey conducted by him and his students, it was found that of 33 young crows only seven left their nests; the remains of many of the others were found in the nests of the owls.

The aspiring crow-hunter should read "Crow Shooting" by Bert Popowski (A. S. Barnes & Company, New York), who has spent many years shooting crows. In this book the crow's ability to decimate the game birds is clearly brought out. Also, on the basis of our own observations at the Arboretum, it would appear that the quail-hunter is virtually obliged to spend as much

time killing crows in the summer as he hopes to spend hunting game in the autumn.

A congregation of over 200 birds using a roost along Brush Creek was recently reduced to about 25. It was hoped that their elimination might increase quail and other birds and that there would be fewer bent and broken leaders among the conifers in the Pinetum. A heavy load of sleet plus the added weight of a crow can do considerable damage to a long evergreen shoot. However, the killing of another hundred crows in the Arboretum a few months later would indicate that the crow population in eastern Missouri is so great that an area cannot be freed of these birds. Any reduction in one section or in one roost simply means that the overflow from surrounding territories will move in. In practice, the process appears to be similar to dipping a bucket of water from a lake and then looking for the hole! This does not mean that every one of the original population was destroyed. In fact there are some very wise birds that have been through a few "shoots." These birds view any hysterical call for help with a superior air; they come in "on oxygen," well out of range, and leave immediately if they suspect a concealed gun. One morning a single crow located a Criders Hawk near the Arboretum nursery and his raucous calling for help failed to arouse any reinforcements. Without his usual companions he gave up the fight in disgust. This should prove very encouraging to both the song and the game birds.

NOTES

Mr. Paul H. Allen, Tropical Collector to the Garden, of Golfito, Costa Rica, spent two weeks in the herbarium recently, working over his Panama plant collections.

Recent visitors to the Garden include Dr. E. H. Runyon, Mycologist, Lawson Hospital, Chamblee, Georgia, and Dr. Carl B. Umanzio, of Kirksville College of Osteopathy and Surgery, both of whom are former graduate students in the Shaw School of Botany; and Dr. Eric Akerberg, of the Royal Agriculture College, Uppsala, Sweden.

With no early frosts and with long spells of warm or even downright hot weather, summer bloom has continued in the Garden as never before. The roses flowered prolifically until checked by the cold snap on November 3, though the tender bedding plants in the Italian garden were hit by the first light frost in October. The water-lilies were still in fine bloom the first week in November; for the first time since the big display pools were built they were in excellent condition up to the very moment when the chrysanthemum show was ready for the public.

THE MISSOURI BOTANICAL GARDEN

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Rolla M. Tryon ..... Assistant Curator of Herbarium
George B. Van Schaack ..... Honorary Curator of Grasses
Julian A. Steyermark ..... Honorary Research Associate
Nell C. Horner ..... Librarian and Editor
Gerald Ulrici ..... Business Manager
George H. Pring ..... Superintendent
Paul A. Kohl ..... Floriculturist
Ladislaus Cutak ..... In charge of Succulents
Kenneth A. Smith ..... Engineer
August P. Beilmann ..... Manager of the Arboretum, Gray Summit
G. R. Lowry ..... In charge of Orchids
Paul H. Allen ..... Tropical Plant Collector

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 50,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until 7:00 p. m.; Sundays, 10:00 a. m. until 7:00 p. m. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah bus line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.

MISSOURI BOTANICAL GARDEN BULLETIN

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Volume XXXVIII December, 1950 Number 10

Cover: *Strombocactus disciformis*, collected in Mexico by Ladislaus Cutak.
Photograph by Ladislaus Cutak.

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Missouri Botanical Garden Bulletin

Vol. XXXVIII DECEMBER, 1950 No. 10

GROWING AND ENJOYING SUCCULENTS

LADISLAUS CUTAK

The aim of this BULLETIN is two-fold: first to give information on the cultural practices of one of the most fascinating groups of plants; second, to point out the many uses to which these plants lend themselves.

Collectively, the cacti, spurges, stonecrops, and all other fleshy-stalked or thick-leaved plants, structurally adapted to live for prolonged periods without water, are known as Succulents. Succulents are distributed throughout the world—in both temperate and tropical regions. A great many of them are desert species, inhabiting dry plains, canyons, and hillsides; many are also found on bleak, ice-covered mountains and in humid tropical forests. All are exceptionally fat and juicy and because of this condition usually assume such "out-of-this-world" appearances that they can be easily spotted. The cacti are perhaps the most unique of all the succulents.

GROWING FROM SEEDS

One of the most fascinating phases of succulent culture is growing them from seed. Generally this will require patience, but it is the cheapest means of obtaining a nice collection of these plants. Then, too, seedlings become healthier and better-looking plants than those gathered on the desert. Mature plants from the wilds adapt themselves to home conditions with more difficulty.

Those who are blessed with a patient temperament will get a thrill watching succulents germinate. Tiny ball-like bodies or spindly cylindrical shapes pop out of the ground. Soon spiny tufts make their appearance, followed by more of these bristle-like growths, until the permanent characteristics of the parent plants become recognizable. Many delightful moments are in store for the seed-sower before the seedlings reach maturity. Why not try your luck!

Even the apartment-dweller can grow a goodly number of seedlings in his home. The only equipment needed is a flower-pot, a piece of glass for cover, a saucer underneath to hold water, some good porous soil, and a

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1. Material for seed propagation. 2. Germination of seeds. 3. Transplanting into flat.

package of fresh seed. However, the writer's experience has been that often a much higher percentage of germination resulted when the seeds were at least a year old than with seeds sown shortly after harvesting. Frequently plants from seeds two and three years old grew into fine specimens.

Most succulents produce seed in abundance. Should seeds be harvested from home-grown plants it is advisable to remove all adhering pulp by rinsing the seeds in water and then drying them out. Firms specializing in cactus seeds are not too plentiful in the United States, but most succulent plant nurseries handle seed packets for the retail trade.

Seeds may be sown any time in the year in a greenhouse. In the average home the ideal time to sow is about the end of April or the beginning of May, although seed may be sown as late as September with good results. During the hot summer months the seeds and small seedlings must never be allowed to dry out completely. On the other hand, the soil should never be saturated. A uniform temperature of 70° F. should be provided for most species but 80 to 90° is better for others, especially if they hail from tropical regions. Light and frequent ventilation are just as important as warmth and moisture. In the home, the seed-pans should be placed in a window with a southern exposure. Germination should not take place in the dark, nor in the full afternoon sun but in partial shade. Fresh air can be supplied by removing the glass cover from the seed-pan, but only on days when the surrounding atmosphere is warm.

For a container, a clean 3- to 4-inch flower-pot is preferred. Cover the bottom with drainage material such as broken crocks, then sift prepared soil to within an inch of the rim. Any good porous soil can be used, but the one recommended and easily prepared consists of equal parts of well-rotted leaf-mold, screened sand, and ordinary garden loam. Press the soil down lightly with a spool or wooden block to insure an even and smooth surface. Care should be taken that the soil cover be no deeper than the size of the seed itself. The tiny seeds may be scattered lightly over the soil, but the larger ones should be sown evenly in rows. Next, fill a saucer with water and place the seed-pot in it. As soon as the surface of the soil becomes moist, empty the water from the saucer. The length of time between such waterings will depend upon the heat and ventilation maintained around the seed-pans. In the home the receptacles are apt to dry out more quickly than in a greenhouse, so that it might be necessary to water every fourth or fifth day. Never water from the top unless a very fine mistlike spray can be had. Overhead watering usually causes seeds to float and become bunched up. When the soil has been moistened, place a glass cover over the seed-pan and set it in a well-lighted window. Whitewash or paint the glass lid to prevent rapid soil-drying or scorching of seedlings.

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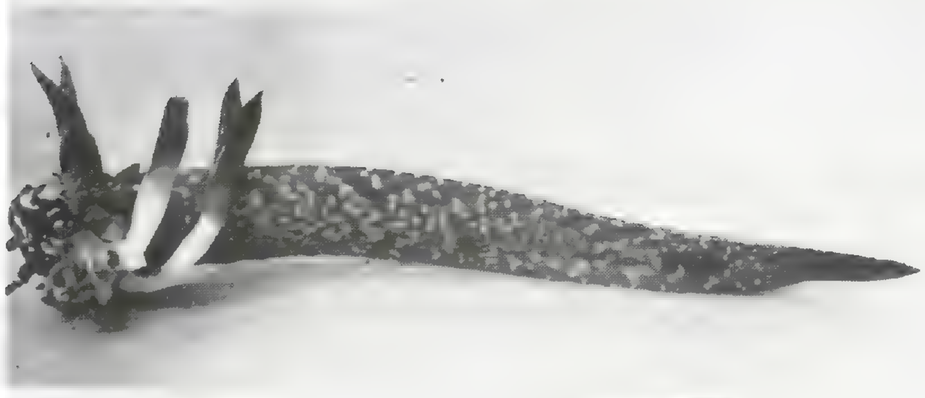

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1. *Bryophyllum daigremontianum* plantlets growing on leaf margin. 2. Gasteria leaf sprouting. 3. Peanut cactus, which can be propagated from each joint. 4. Opuntia fruit propagation.

Generally, tiny seedlings begin to push their way up in seven to fourteen days. Raise one side of the glass by inserting a match stick under it and, after about a week, begin exposing seedlings to gradually stronger light. Water from below until the plants become sufficiently strong to withstand overhead spraying.

Early transplanting is to be avoided unless the tiny seedlings begin to crowd each other. Shift into flats, larger seed-pans or 1½-inch pots. In transplanting use the same mixture of soil as for the seeds. If kept in small pots there is less danger of overwatering.

OTHER METHODS OF PROPAGATION

In addition to propagation by seed, most of the succulents can be multiplied vegetatively, i. e., by cuttings, by division of large clumps, by offsets, by leaves, etc. With these methods plants will attain maturity much sooner than when grown from seed.

Almost any portion of the stem can be cut off, treated, and forced to produce new growth. All cuttings with a large cut surface, such as in cacti and spurges, must be placed in a dry atmosphere for a few days in order that a callus form over the wounded section. This is very important, for unless the cuticle is healed the cut surface would be subject to bacterial rot, which would quickly destroy the cutting. Succulents with small exposed surfaces, such as the sedums, stapeliads, and mesembs, form a protective tissue in a few hours. Although most cuttings may be placed directly in a mixture of sand and soil, pure sand or vermiculite seems to be a better rooting medium. Some plants will produce a vigorous root system in a week. New shoots along the stem are a good indication that the cutting is forming roots. Water should be applied very sparingly or not at all until some sign of growth appears. Cuttings of tender succulents—the leafy kinds—must be shielded from the direct rays of the sun and their exposed parts lightly sprinkled to keep them from wilting.

Many plants, as, for instance, the Opuntias (Prickly Pears), the Kalanchoes and Bryophyllums, are naturally adapted to vegetative propagation. The stems and green fruits of most Prickly Pears break off very easily and fall to the ground, where in a short time they throw out roots and develop independently as new plants. Many succulents produce numerous tiny plantlets along their stems or on the margins of the leaves. A good example is the South American Echinopsis with long trumpet-like flowers, commonly known as Easter Lily Cactus. Most species, particularly *E. Eyriesii* and *E. multiplex*, produce numerous offsets, either at the bottom or top of the old plant, which readily become detached from the mother plant and strike root in the surrounding soil.

The Bryophyllums offer a good example of leaf propagation. Their name, from the Greek, meaning "life leaves" was given on account of the numerous plantlets which are produced along the margins of the leaves. These plantlets fall off easily, cluttering the soil around the mother plant and eventually becoming even a nuisance. Most of the crassulaceous plants, such as the stonecrops, hen-and-chickens, Kalanchoes and Bryophyllums, can be readily propagated by leaf cuttings. Simply remove a leaf, place it in sand or on top of the soil, keep it somewhat moist, and the baby plants will appear. Later these can be potted as seedlings.

GRAFTING

The art of grafting provides a simple means of uniting two distinct plants and inducing them to function as one. Grafting is resorted to for a variety of purposes, such as accelerating growth of slow growers, preserving species that are susceptible to rot when grown on their own roots, insuring a greater number of flowers, developing bushy and more decorative plants, preserving abnormal forms such as crests and monstrosities, and raising varieties that are considered difficult to grow.

Only cacti, spurges, and stapeliads are generally grafted. The best time for the operation is from May to September, when the plants are growing well. Grafting during other months should be resorted to only when it becomes necessary to save an injured or diseased plant.

There are three kinds of grafts commonly employed—the cleft, the flat, and the side. All thin-stemmed plants are suitable for cleft grafting while the thick and globose types require a flat graft. In cleft-grafting cut back the stock to a desired height (usually six to twelve inches) for cacti such as the Christmas Cactus and then make a slit at the top about an inch deep. The cut should never be much longer than the insert if a perfect union is to be attained. The stem of the scion (the plant to be grafted onto the rooted stock) is then cut on two sides to form a wedge and inserted into the split of the stock. After firming the graft into the desired position, the scion is held in place by running a cactus spine or two through the united portions and then wrapping some cord or raffia around the graft. The cord should be taut enough to hold the scion in place and yet not so tight as to cut into it or the stock.

In the flat graft both scion and stock should be of approximately the same width at the intended union. After selecting the two plants make a smooth transverse cut on each specimen and then place the scion on the severed stock, pressing the two flat surfaces firmly together. To hold the scion in place use two large-size rubber bands, placing them gently over the top of the scion and run underneath the flower-pot. String also can be used, but

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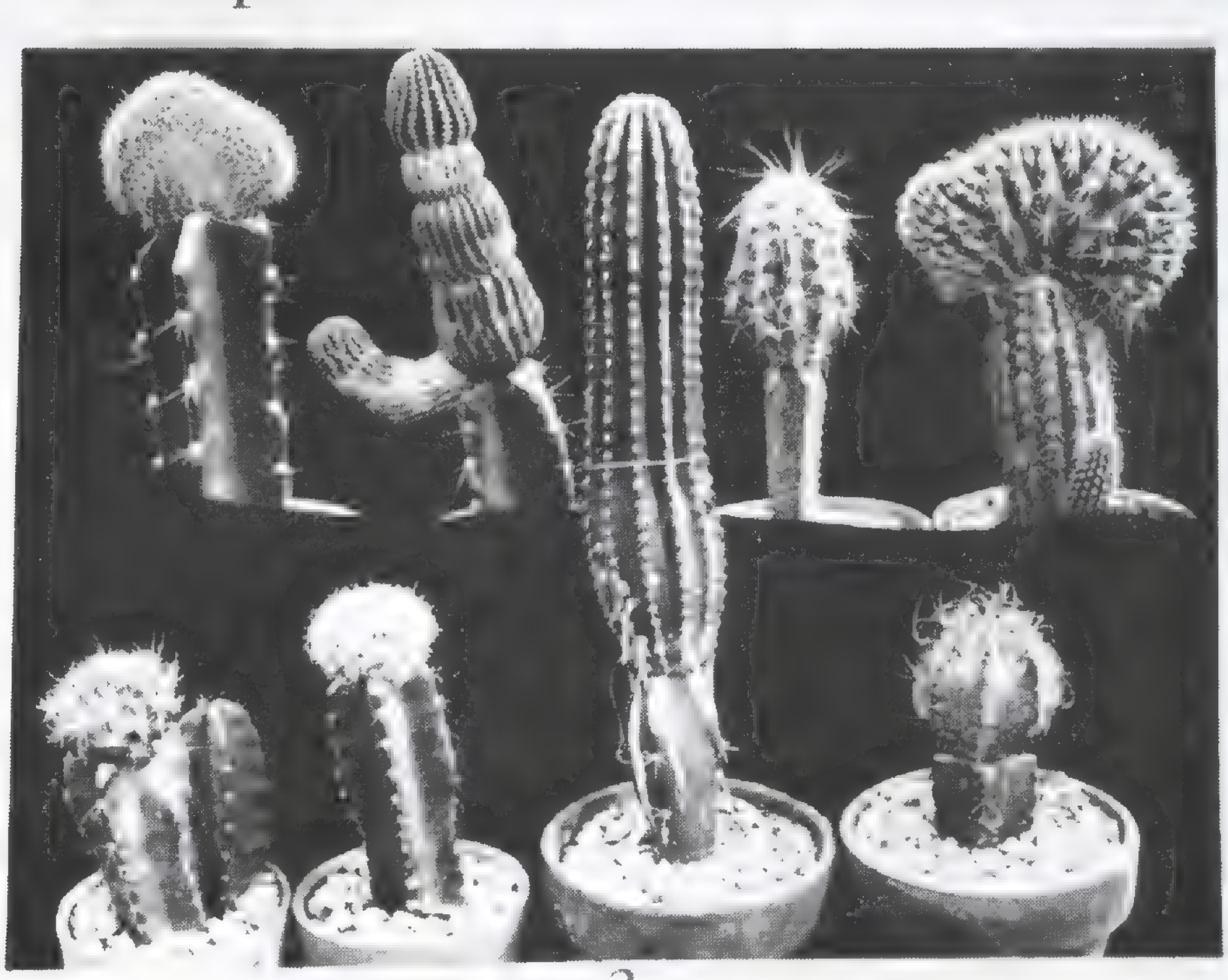

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Cleft grafts: 1. *Aporocactus flagelliformis* on *Hylocereus undatus*. 2. *Zygocactus truncatus* on *Selenicereus pteranthus*. 3. Flat gratts.

first file four small grooves on the flower-pot rim and bottom to prevent the cord from slipping. A grafted plant can also be held in position with a piece of flexible wire bent in "U" shape.

The side graft requires no special operation beyond slicing one side of both scion and stock and holding the two joints in place. Slender plants such as the Mistletoe Cactus and Peanut Cactus are usually used for this type of grafting.

When grafting operations are completed, set the plants in a warm place but a shaded one, so that the cut surfaces will not dry out too rapidly, preventing perfect unions. Apply water to the stock plant taking care that no moisture reaches the graft. Inspect all grafts occasionally to note whether union has formed properly. Sometimes certain stocks, especially Pereskias, have a tendency to produce suckers or offsets at the base or infrequently along the stem. When these appear they should be removed immediately; otherwise the scions will be deprived of much nutrient matter and the growth of the grafts will be hindered. After grafted plants have become established only normal care is necessary. It might be practicable to transplant grafted plants once a year or at least to add a little fertilizer. Liquid manure is beneficial in the growing season.

SEASONAL CARE

To consider that succulents, especially the cacti, need no attention, is a fallacy. Even among cactus plants different cultural methods must be applied. The great majority are found growing under the hot sun and in poor soil where the rainfall is very scanty; and yet under such conditions the plants prosper and flower freely, for they have developed the ability to take up and store within their stems the moisture which at intervals comes their way. The Barrel Cacti, the Fishhooks, the Pincushions, the Hedgehogs, and the wicked Chollas are but a few belonging to this class. They are generally very spiny, the spiny armament acting as a shield against the scorching rays of the sun. Plants of this type are very desirable for home culture, as they are able to withstand the hot, dry atmosphere of our living rooms. The Christmas Cactus, the Broadleafs (erroneously known as Night-blooming Cereus), the Rhipsalis, the Rat-Tails, and the trailing Night-blooming Cerei, are mostly epiphytic, growing with the orchids and bromeliads upon the trunks and branches of trees in tropical America. These, then, require a richer soil (but very porous) and humid surroundings, and can be grown successfully in sun-rooms or screened porches.

Cacti from the hot deserts, as the Barrels, Old Men, and Saguaros, must be watered only every three to four weeks during the winter months, and then only on clear, sunny days. The best method is to place them in a large vessel of water, thereby moistening the roots only. The Christmas Cactus

and similar varieties must never be allowed to get very dry, although a short rest period from September to November and again after flowering is recommended. Other succulents, such as the Mesembryanthemums and Crassulas, need more water than a cactus. However, it must be remembered that good drainage is necessary at all times, as very few succulents will survive if their "feet" are constantly wet.

Most succulents should be given a period of rest for three or four months during the winter, when they should be placed in a cooler room and watered more sparingly. If kept growing all year round no buds or very few will appear. Winter months, as a rule, are the danger months for succulent plants, but if proper attention is given to temperature, water, etc., no difficulty should be experienced. All plants that have been planted outdoors during the summer months must be brought indoors about the first of October. Many cactus plants that are whipped by bitter winds and covered under a blanket of snow in the mountainous regions of the Southwest cannot endure the winters of the Middle West. It isn't the cold that plays havoc, but the excessive dampness combined with cold. Sunlight is an important factor in the life of a plant, and in order to obtain all that is possible in the winter the plants should be placed on window sills or near windows. Without light, plants will grow stringy, weak, and sickly, or will die.

On clear warm days during March, all succulents should be taken outdoors but must be brought in or covered for the night if a great drop in temperature is expected. During April they can be left on the porch but careful watch must be kept for likely frosts. By keeping the plants outside for part of the time, they are prepared to withstand the intense sunlight and warmth later. Usually, during May, plants can be set out permanently, either in rockeries, beds, or in borders. Because of the heavy spring rains in our Middle West, succulents should be planted on a slope so that excess water will readily drain off. Although plants will do better if planted directly in the soil, the average worker will not have the time to dig them up carefully and repot them in the fall; rather the pots should be plunged in the ground to within an inch of the rim and the surface covered with gravel, limestone chat, or other small rocks. It should be remembered that succulents, in order to ripen their stems, need all the sun possible during the fall months and they should be left outdoors as long as possible. A light frost will not bother the hardier types, and they usually may continue outside until about the end of October in the St. Louis area. The first of October is the deadline for the tender kinds, but if a warm spell occurs at that time (as it often does) they may be left out until the temperature begins to drop. Succulents exposed to the sunshine, the air, and rain during the summer months will do far better than those kept indoors.

CARE OF THE CHRISTMAS CACTUS

The Christmas Cactus (Zygocactus) is one of the best and most popular of all old-fashioned house plants. When we attempt to grow this cactus in our homes we should strive to treat the plant as a jungle inhabitant rather than as a desert species. The soil mixture must be richer and the water supply ample. Since the Zygocactus has been the subject of more inquiries at the Garden than any other plant, the following cultural directions are given.

Growing Christmas Cactus isn't difficult. A soil mixture composed of light loam, well-rotted leafmold, some sand, and a generous sprinkling of well-decomposed cow manure will suit the plant well. If the plants are placed outdoors during the summer, under a tree or in some other shaded spot, they will grow sturdier and will be able to ripen their wood more thoroughly. An occasional application of liquid manure is beneficial, and daily syringing is recommended during the warm months. In the autumn begin to "rest" the plant by reducing the watering until only sufficient is applied to keep the soil from drying out completely. The autumn resting period may be started in September and terminated in November. During this period some joints or links will drop off, but this should cause no alarm; and it is also at this time that buds are induced to form. When the tiny buds begin to show, watering may be resumed, usually every other day. While the buds are forming it is advisable not to sprinkle overhead, not to move the plant about, and to avoid drafts. Any of these operations might cause the buds to blast and fall off. A sudden change in temperature is also injurious. Only when the blossoms begin to unfold can the plants be moved about or sprayed.

Zygocactus may start blooming in November and finish in March, but the heaviest bloom is usually in December and January. A period of rest should follow the blooming season. During this second dormancy the plants will have a tendency to become weak and drooping, in which case don't be afraid to cut off the joints. Withhold water, but never allow the soil to get bone-dry. Usually two or three waterings will suffice during this four- to six-weeks rest period. After this forced dormancy the shrivelled branches will take on a healthier appearance and new stems will develop. Shortly, warm weather will arrive and plants can be left outdoors to begin another cycle.

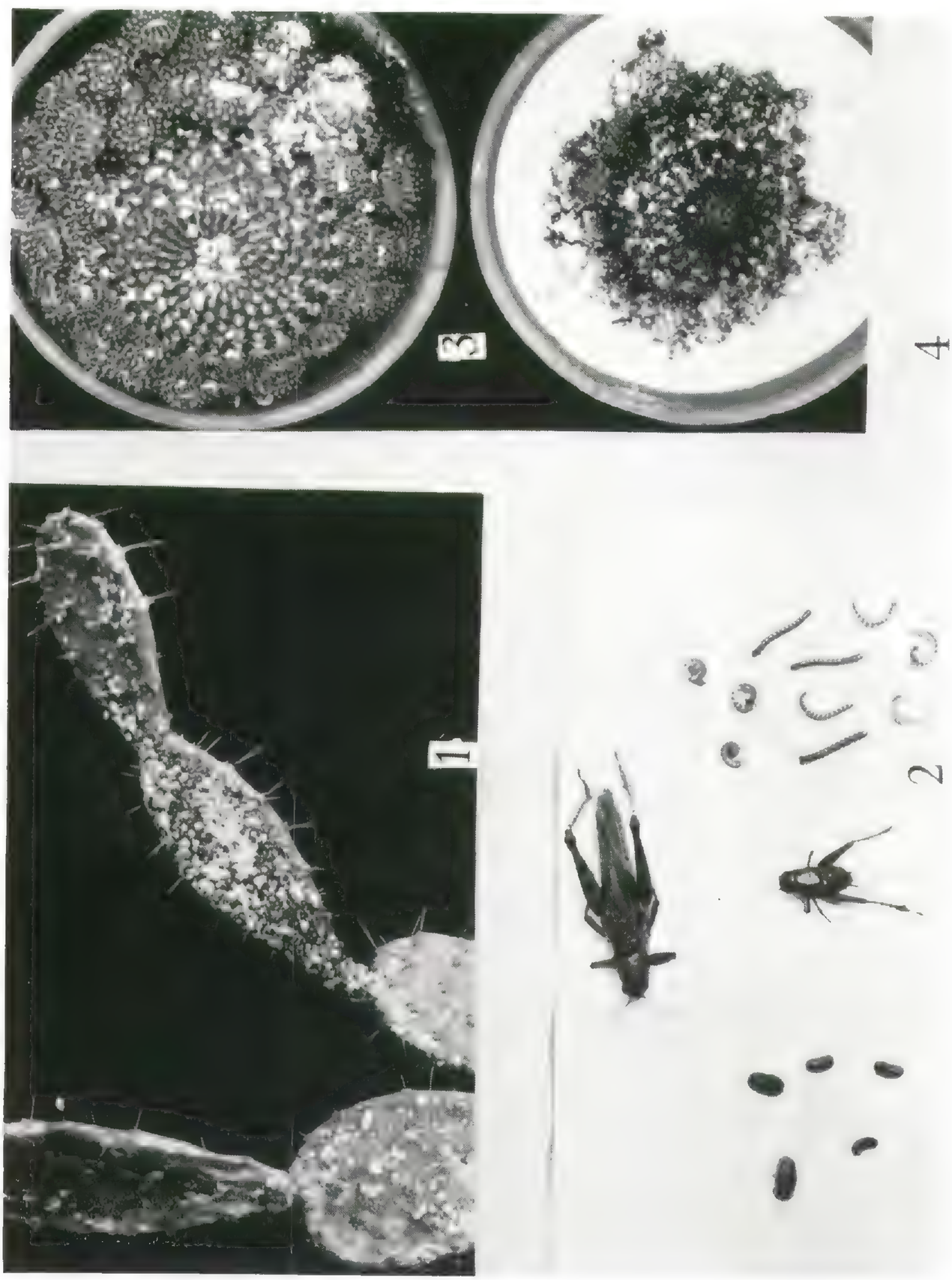
DISEASE AND PEST CONTROLS

There is nothing more discouraging to the plant grower than sickly, crippled, or dying specimens. Under artificial conditions in the home or greenhouse the grower may be annoyed by a number of common garden

pests, but a collection can be kept surprisingly clean if a careful watch is kept and insecticides used judiciously. First, one must learn to know whether the "bug" feeding upon the plants is a chewing or sucking kind. Sucking insects commonly encountered are aphids, mealy bugs, and scales. These are chiefly introduced from the garden, or from some other house plants. They must be killed by contact, whereas the chewers, such as grasshoppers, beetles, and larval "worms," will require stomach poisons.

In home collections the grower is apt to meet only a few pests, chiefly aphids, mealy bugs, scales, thrips, and red spiders, and all these can be controlled by dependable oil sprays such as Volck. Mealy bugs are easily recognized because they cover themselves with a white cottony substance and usually congregate on the tips of spines, in the grooves of new growth, at the base of joints, under leaves and about the roots. Frequently a forceful spray of cold water from the faucet will dislodge the mealies and wash them down a drain. However, it is a good practice to use an oil spray regularly to keep plants free of this pest. Aphids, or plant lice, are soft-bodied insects about the size of a pin-head, either black, green or yellow, most frequently found on new growth and on leaf and flower buds. A nicotine spray easily controls them. Scale insects are just what the name implies—tiny animals with either a soft or hard, more or less arched shell, that fasten themselves to stems, branches, and leaves where they extract juices. An oil-emulsion spray aids in smothering them. Mealy bugs, aphids, and scales also excrete a sticky honey-dew, which is much sought after by ants. The ants, to assure themselves of this delectable food, tend and pasture the pests and guard them from their natural enemies. They also transport the "bugs" to other plants, so it is a good idea to rid the premises of ants. Nicotine easily kills ants on contact, but Chlordane, a new insecticide, is the most efficient ant control I have discovered so far. It is also effective against cockroaches and other injurious insects. Chlordane powder mixed with talc may be sprinkled around the pots or wherever ants have their trails, or it may be mixed with water and applied as a residual spray which is good for about a week.

Thrips are tiny brown or black insects, quick in their motions. When disturbed they curve their abdomens over their backs and seemingly jump for cover. Thrips rasp the tissues of seedling cacti and tender succulents, leaving them scarred and unattractive. An oil spray containing nicotine will control them. The red spider is a tiny mite hardly perceptible to the eye, but detected by its characteristic injury to the plant,—a blotched, rusted appearance with leaves and joints eventually drying up. Red spiders spin webs under which they live and feed and they thrive under hot and dry conditions. The same control as used for thrips is recommended.



1. Scale-infested Opuntia joints. 2. Harmful chewing insects—sow bugs, grasshoppers, crickets, millipeds. 3. Rebutia attacked by mealy bugs. 4. Rebutia killed by mealy bugs.

In the greenhouse a few additional pests may be prevalent, such as sow bugs, millipeds, snails, slugs, and grasshoppers. Sow bugs are scavengers, usually found under a pot or on the bench wherever there is moisture. They are true crustaceans rather than insects and feed upon tender stems of succulents, particularly cactus seedlings. Several prepared poison baits are sold for their eradication but a home-made formula consisting of nine parts of brown sugar to one part of Paris Green scattered about the benches or soil is just as effective. This same formula will work for other chewing pests, such as grasshoppers, or for millipeds, which are responsible for disseminating certain bacterial and fungus organisms. The millipeds also attack roots and stems of plants and fleshy seeds in seed-pans.

Damp-off disease frequently takes a high toll of seedlings. This disease is caused by a fungus and occurs when seedlings are too crowded, exceptionally moist, and kept in a close atmosphere. A disinfectant, such as Semesan, may be used as a remedy. Try not to permit green moss or algae to spread on the soil or flower-pot. There are various types of rot that attack succulents, which are caused by fungi and other pathogens. Be careful not to bruise, puncture or prick a plant. No matter how small the open wound it might be the means of entry of a harmful parasite which, if not caught in time, might kill the plant. When soft spots are noticed remove all diseased portions, cutting well into the healthy tissues, and see to it that cuts dry quickly in fresh air in order to facilitate healing.

Rot disease can also be started by drying off plants too completely, causing the roots to die, and then watering heavily. It can also be due to too much watering, especially if the soil is kept soggy for long periods. This kind of rot gives a wilted and often discolored appearance to the plant. The remedy for root rot is to cut off all dried or rotted matter, then after the cuts are healed, repotting the plant in fresh soil and withholding water until new roots are formed.

Occasionally tips of cacti may dry up or a corky tissue will discolor the stems. Nothing can be done about this. The cactus itself will fight the disease and wall-off the infected portion to keep it from spreading. As soon as the cactus checks it and the dried portions are really dry they can be knocked off easily. Of course, a permanent scar will remain.

In order to control insect pests and plant diseases, spray regularly even though insects are not apparent; use disease-free soil for potting; prevent the formation of molds; harden the stems by exposure to sunlight and fresh air; keep the premises clean; and learn to handle the plants carefully.

INDOOR COLLECTIONS

No other house plants demand as little attention and give as much pleasure and satisfaction as do the succulents. In the warmth of a well-

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1. Indoor sunporch collection. 2. Cacti and succulents in outdoor collection.

lighted window many fascinating jungle and desert species look exceedingly attractive. There are hundreds to choose from in all imaginable shapes and forms, ranging from tree-like to tiny balls covered with intricate patterns of spines, wool, hair, or waxy bloom. It would be difficult to pick out a hundred outstanding varieties because there are nearly 4,000 succulents in existence and taste varies with the individual grower. Some growers are partial to certain groups such as the easy-flowering types, the hairy or woolly forms; some prefer mimicry plants or the grotesque monstrosities and crests; while others delight in possessing a mixed assortment.

Although a greenhouse is the ideal place to grow all kinds of plants, cacti and succulents are not particular where they grow as long as a few rules are followed. A sunlit window is the most common compartment for these plants in the average home and it is surprising how many different kinds can be grown to perfection in such little space. Particularly, in the winter when there is a noticeable absence of green living material about the home do succulents become desirable, although they offer a colorful display at all times.

Cacti and other succulents can be made attractive on shelves built into the window, or a glass extension may be built outside the window, serving as a miniature greenhouse. Alcove windows and sunlit porches are also ideal locations. In poorly lighted sections of the house, plants will make unsightly weak growths and will be more susceptible to insect pests and plant diseases. Give your succulents all the light possible, particularly in the winter months.

The containers in which to grow cacti and other succulents need consideration also. For slow-growing plants it is best to use smaller pots than would ordinarily be used for familiar plants of like size, for then one is less likely to overwater. Since very small pots dry out quickly they can be set in a large tray or metal box filled with sand and the sand kept moist. Frequent repotting is not necessary. Glazed pots are very attractive and, although quite expensive, are all the rage now. Choose one that will hold an appreciable amount of soil, and if necessary drill a hole in the bottom for drainage. If this is not possible place a generous supply of fine gravel at the bottom and be sure to add charcoal.

The beginner will be at a loss to know how to choose the most desirable varieties of succulents. In the average home, where space is at a premium, more satisfaction will be derived if the grower concentrates on a few individual groups rather than on a general collection.

Plants of the genus Mammillaria are probably the most popular among beginners and can be called the darlings of the Cactus family. For the most part, they are small plants with simple or clustered, cylindrical to globular bodies covered with numerous tubercles or nipples, these being capped with areoles from which arise delicate or strong spines of various sizes. Their

Methods of displaying cacti and succulents in the home.

flowers are small, more or less bell-shaped, but they make up for their size by being produced in abundance in a dazzling red, pink, white, yellow or purple crown. The beauty of the plants is further enhanced by the colorful club-shaped fruits, which, in some species, appear mixed among the flowers.

All the species of Mammillaria—and over 250 have been described—are very attractive, but the following are outstanding and should be included in every succulent collection. The Birdnest *(M. camptotricha)* is a very floriferous Mexican species with conspicuous long nipples and thin yellowish twisting spines. The Powder Puff *(M. bocasana)* is covered with long white silky hairs which veil the short brown hooked central spines. The Old Lady *(M. Habniana)* is a "real darling" with long white flowing hairs. The Lady Fingers *(M. elongata)* is a slender cylindrical form composed of several finger-like green heads copiously covered with slender yellow spines. The Featherball *(M. plumosa)* is a curiosity. The individual heads are small and possess feather-like spines instead of the usual vicious needle-like prickles. Some of the best Pincushions are: *M. Parkinsonii* with chalk-white spines; *M. elegans* crowded with short tubercles and stiff bristle-like spines; *M. microcarpa* with hooked central spines and captivating lavender-purple blossoms; and *M. applanata*, a level-topped species with scarlet club-shaped fruits.

Many cacti flower quite freely and some of the most profuse bloomers are contained in the genus Rebutia, often referred to as Tom Thumb cacti. Many of them are thimble-size but often grow in clusters covered with brilliant flowers. The Chin Cacti or Gymnocalyciums are also small globular plants with attractive flowers. One of the most popular is *G. Mihanovichii*, a dark green body with maroon markings and bright green flowers. Lobivias hail from Bolivia, and possess exquisite blossoms of red, yellow and orange hues. The genus Notocactus contains bewitching species which should not be overlooked. A "must" for the beginner is the Twisted Rib, *Hamatocactus setispinus*, which usually flowers from spring until frost. The Bishop's Cap, *Astrophytum myriostigma*, is a spineless species with a profusion of silken yellow blossoms.

Those who are not partial to free-flowering types will enjoy collecting mimicry plants. Among these are: the Totem Pole, *Lophocereus Schottii monstrosus*, a curious spineless form which resembles a knobby column of green jade; the Living Rocks (Ariocarpus); the Dumpling Cactus, *Lophophora Williamsii*, and many others.

It is simply impossible to list all the interesting cacti and succulents in one BULLETIN, but there are two very informative books for those who wish to follow the hobby more extensively: "Cacti for the Amateur" by Scott E. Haselton and "Succulents for the Amateur" by J. R. Brown and collaborators, both published by the Abbey Garden Press, Pasadena, California.

DESERTARIUMS

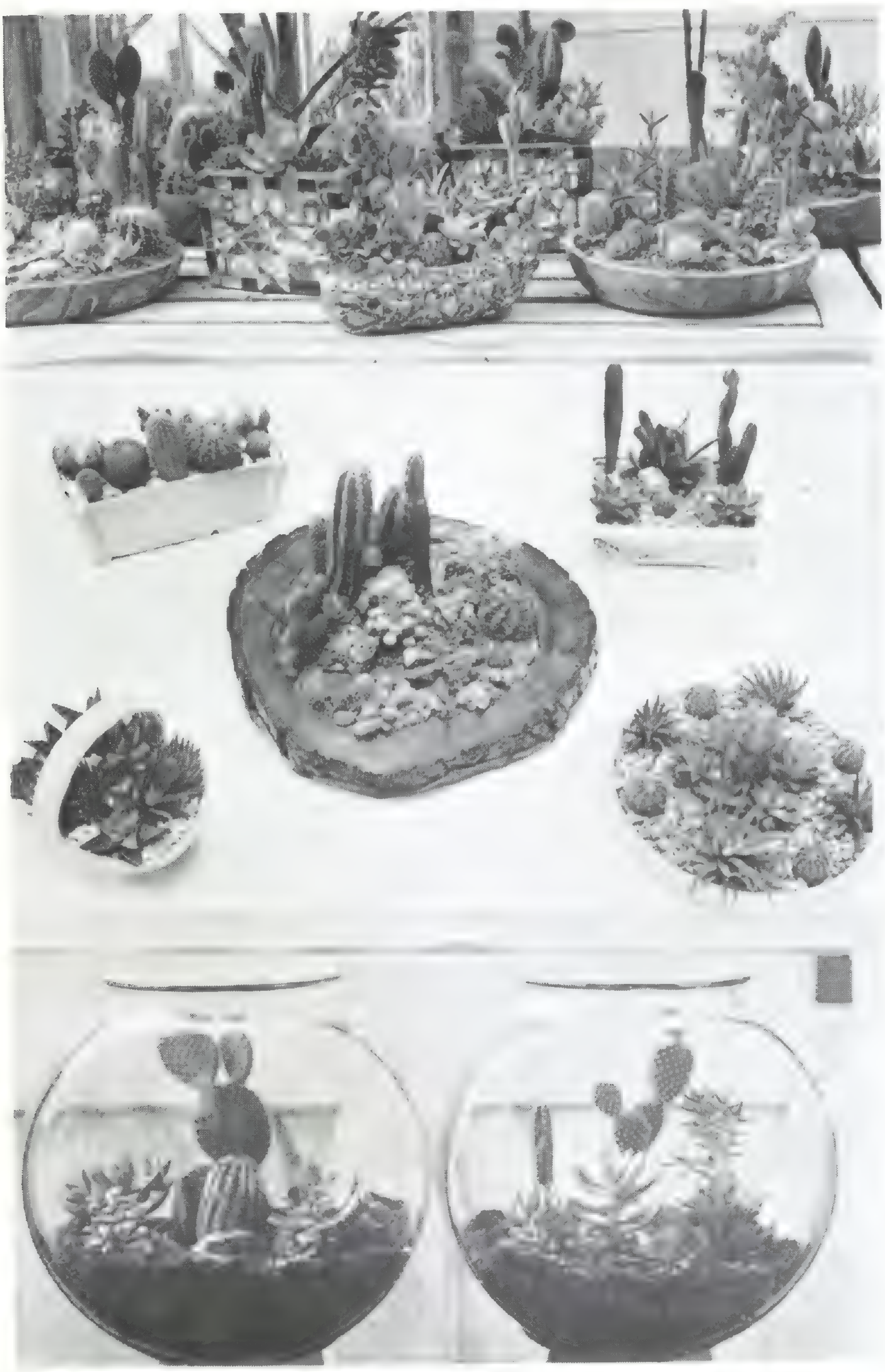
Glass gardens or Wardian cases, with their plantings of woodland and jungle species, have been popular for over a century. It was a London physician who accidentally stumbled upon a method of growing tender plants in glass bottles. He began to experiment with all types of plants in various glass cases and soon his discovery found a very practical use in the transportation of plants between countries. From this humble beginning evolved the desertarium, which is really nothing more than a miniature glass-enclosed desert garden. A desertarium as a house decoration can hardly be beat. To the shut-in such a garden affords a fascinating opportunity to study plant life; to the housewife it is a blessing, for the containers can be handled easily when cleaning is on the day's agenda.

How can a glass garden be started? Simply choose a suitable container of clear glass with smooth top edges so that a square of glass will fit smoothly on it. The most satisfactory are the 1- to 2-gallon drum-shaped aquariums and the 5-gallon (or more) rectangular aquariums. For the beginner a small rectangular aquarium is better than the drum-shaped as the full top opening permits the use of both hands in working with the plants.

Drainage is of the utmost importance in growing succulents in glass gardens. Gravel, sand, or other coarse material (gravel preferably) must be laid to the thickness of one inch at the bottom of the container, then several pieces of charcoal placed on top, or mix powdered charcoal liberally with the soil—this to prevent the soil from souring. Since soil is not attractive when seen through the glass the walls may be lined with sphagnum or any ordinary woodland moss to the height of the intended soil level, the mossy side facing the glass. The soil mixture is then added and packed against the sides and bottom to a depth of about three inches. Rich loam is to be avoided for cacti in desertariums; instead use a mixture of sand, well-rotted leaf-mold, and ordinary garden loam.

A hodgepodge of plants is never recommended nor should the plants be crowded as in a woodland or exotic jungle scene. Small plants should be chosen, or slow-growing ones. Cacti, generally, will thrive better in glass cases than other succulents, yet a few species such as the liliaceous Haworthias can be successfully grown with them. The Haworthias are small rosette-forming plants which simulate century plants or Agaves of the American deserts. Be sure to include at least one or two species in the desertarium. Sedums, Kalanchoes, and Bryophyllums should be avoided, for they tend to become "leggy" and soon push their way up through the opening, presenting anything but a tidy appearance.

Cacti can be arranged according to the individual's taste but some really effective desert scenes may be worked out by following the desert pictures in



Dish gardens and terrariums

popular magazines. A miniature dime-store Mexican, with perhaps a thatched hut and burro figurines, can be added to complete the picture. Meaningless ornamentations should be avoided. Well-placed stones to represent large boulders and mountains need be the only trimmings in a cactus-planted desertarium.

After plants have been pressed into the soil it will be a good idea to cover the surface of the soil with sand or fine gravel, making sure that enough of this material lies at the base of the plants to act as a protecting cover against rot diseases. Finally clean the inside glass as carefully as the outside and if any dirt, sand or gravel adheres to the plants remove with a small brush. If care was exercised in transplanting, the desert garden may be moistened lightly. However, if the plants have been bruised, two or three days should elapse before applying water.

When all operations are completed, place the terrarium where it will receive an abundance of light, for this is its chief requisite. In the evening these containers may be placed in conspicuous positions in the home, as on mantels, pianos, end-tables or in wall niches, where they are sure to attract deserved attention. A lighted desertarium will be even more attractive. The top should be partly covered with a square of glass slightly larger than the opening, and only removed when too much moisture within threatens to destroy the plants.

Fresh air is as important as light and the top plate should be placed to one side so that about an inch of space remains open. On sunny days in summer the glass cover can be fitted tightly over the opening to permit "sweat" inside which will materially benefit the plants. If this procedure is faithfully followed about twice a week no water need be added for several months. If water must be applied it should be not oftener than once or twice a month, this again depending on how fast the containers dry out. If moisture lingers for long intervals around the plants, remove the lid and permit the soil to dry out. Pay especial attention to this during cloudy winter months. Desertariums require very little care after once planted and should last for a number of years.

DISH AND BUTTON GARDENING

Many cactophiles trace their start to a bowl of cacti or a dish garden seen in some floral shop or exhibited at a flower show. There is no denying that these miniature rock gardens hold fascination to those who wish to create pictorial arrangements. For a dish garden, one or more flat dishes, made of some glazed ware, should be obtained. These should be quite shallow, about three inches in depth, and may be of any shape that suits the fancy. The first step is to cover the bottom of the dish or bowl with a layer of gravel. Add a mixture of good porous loam, such as recommended in previous para-

1

2

3

1. Succulents for ladies' hats. 2. Succulents in corsages. 3. Button gardens.

graphs. Firm the soil with the fingers so that the dish is about half full. Some idea of the exact design of the garden should be had. It is well to put rocks into position when the dish is half full and more soil pressed tightly round them. A center of interest should be maintained, with proper enclosure on the back and sides by means of larger rocks and plants.

The planting of the garden is of course a matter of individual taste. However, some knowledge of related plants should be had and simplicity should be the rule. Never overcrowd the bowl with too many kinds of plants. Florists frequently do this to create immediate sales, knowing full well that a full container holds a certain appeal to many buyers. Seedling or dwarf plants should be used in the plantings. Your local cactus dealer can supply you with inexpensive plants which are better than the rare varieties. After the plants are arranged sprinkle the surface of the soil with limestone chat or gravel, but do not water until the second or third day and after that only when the soil becomes dry. Dish gardens will look attractive on the living room table, but during the sunny portion of the day should be transferred to the windowsill to absorb all light possible. When the plants grow big, transplant them to larger pots and replace them with smaller kinds. A well-executed dish garden will excite admiration and interest.

Button gardens are literally dish gardens in miniature. They will not last as long, however, because the plants get no soil or water. Button gardens are comparatively a new fad, being used chiefly as favors at parties. Garden clubs, too, often use this as a project for teaching shut-ins to pass their lonely hours. Any kind of buttons can be used and tiny slips of cacti and succulents glued to them. Large coat buttons serve as excellent bases for miniature scenes on which tiny figurines can even be used. Tips of colorful sedums, single leaves of Crassulas, Kleinias, and other succulents, according to scale, and "pups" from clustering cacti are most frequently used. The moisture stored in the tiny plants will enable them to live on for many weeks. I have kept button gardens in near perfect condition for three to five months. There is no denying that button gardening is a fascinating hobby.

ARRANGEMENTS, CORSAGES, ETC.

In the past few years more and more people are trying their skill with using succulents in flower arrangements. Not only are the plants fit for table pieces, mantel decorations, and corsages but they can be utilized in various other ways and for all occasions. There are several advantages in using this type of material. One is that cuttings can last without water for a long time. They can be taken apart after the particular novelty has served its purpose, the stems rooted and grown again as potted plants. You cannot do this with flowers and non-succulent material.

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2

1. Two types of desertariums. 2. Bridal ensemble of succulents.

In making arrangements for a shallow bowl a needlepoint holder and non-hardening modeling clay is employed. Succulent cuttings of different heights are then pressed onto the needle holder which is fastened to the bottom of the container with the clay. The holder and base of stems are covered with rocks, colored glass, gravel, soil or plant material, and figurines sometimes complete the composition. The plants will remain lovely for several weeks, or until you're tired of the arrangement, and then they can be potted again for the window garden. Common succulents used are the graceful stems of *Bryophyllum Fedtschenkoi*, curving leaves of Sansevierias and Aloes, rosettes of Echeveria, Sempervivums and Aeoniums, sprigs of Crassulas and joints of cacti, particularly Prickly Pear Cactus.

A succulent nosegay or corsage can be retained for weeks if kept cool when not in use. It is also economical and easy to make. In making corsages and nosegays it is only necessary to have on hand some annealed wire, better known as florist's wire, in several lengths and in different gauges, stemming tape (or crepe paper if the former is not readily available), and ribbon. There are two types of formal corsages—the single and the double. The latter, as its name suggests, consists of two single corsages, placed up and down, and tied together in the center where a $\frac{5}{8}$ inch satin ribbon in several bows serves as the centerpiece. You can wear them for several weeks, then replant to furnish more boutonnieres.

Nosegays can be composed of several interesting and easily obtainable varihued succulents. Each stem can be wrapped in green tissue paper to which wire is attached for firmness and the plants tied securely together in a bouquet to form a handle by which it can be easily carried. Usually a large colorful rosette of a Mexican Echeveria forms a centerpiece around which other colorful succulents radiate in pleasing fashion.

Perhaps you may not be one of the individuals to take a "fancy" to new ideas, but after examining a few of the pictures in this booklet you must admit that succulents can find many uses. Take for instance women's hats! With all the fantastic decorations the milliners put on them it is a wonder that the designers have not hit upon the idea of live succulents. At that these glamorous plants would look more conservative and in better taste than what is often seen. All one has to do is to buy a plain hat and attach a few sprigs of long-lasting succulents to it. Lo and behold! you will have a becoming creation. Take notice, Lily Daché and John Fredericks!

And then, too, why not use a few live succulents to decorate that birthday cake. A few years ago when I visited a certain California cactus lady, she baked and beautifully designed in my honor a cake with succulents. Yes, succulents are truly versatile plants, and can be used in good taste for many purposes.

Various types of arrangements utilizing cacti and succulents. Note succulents decorating cake in upper right.

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THE MISSOURI BOTANICAL GARDEN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 50,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until 7:00 p. m.; Sundays, 10:00 a. m. until 7:00 p. m. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove and Flora Place, on the Sarah bus line (No. 42). The Tower Grove bus (No. 21), direct from downtown, passes within three blocks of the main entrance.